ELECTRICAL REVIEW

[ILLUSTRATED.]

A WEEKLY JOURNAL OF

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Hanlon's Elevated Railway Adapted to the Successful Application of Any Motive Power.

Notwithstanding the many obstacles, mechanical and scientific, to the successful construction and operation of a single post structure elevated railway, to which a practical application of any motive power can be readily and successfully applied and maintained at the lowest minimum of cost, the following description and illustration of the above named elevated railway will demonstrate that in this system, results sought for many years can be attained; at the same time ensuring safe and rapid transit at all seasons of the year in any climate.

This system consists in the peculiar and original mounting or method of maintaining the car or cars upon the rail line, which extends along and is supported on a single post structure. The merit of the invention is embodied in the arrangement of two continuous rail lines, vertically disposed with respect to each other, and extending horizontally or approximately so, above and below the cars which move between them. The top rail line is employed as the main or supporting one, which sustains the weight of the car or cars. The lower rail is intended simply to prevent lateral oscillation of the car, or any undue divergence from its proper path of travel, and does not serve as a support for the car; hence by this system a single post line for an elevated railway can be employed with the advantages of the least amount of friction due to the manner of supporting the car or cars upon the upper rail, while at the same time motion of the cars laterally is prevented by the action of the under or guiding rail, and the result is the cars travel steadily and smoothly. The motive power for propelling the cars may be supplied by any efficient, economical prime motor, especially an electric motor, which is the most economical and otherwise desirable for this purpose with this system.

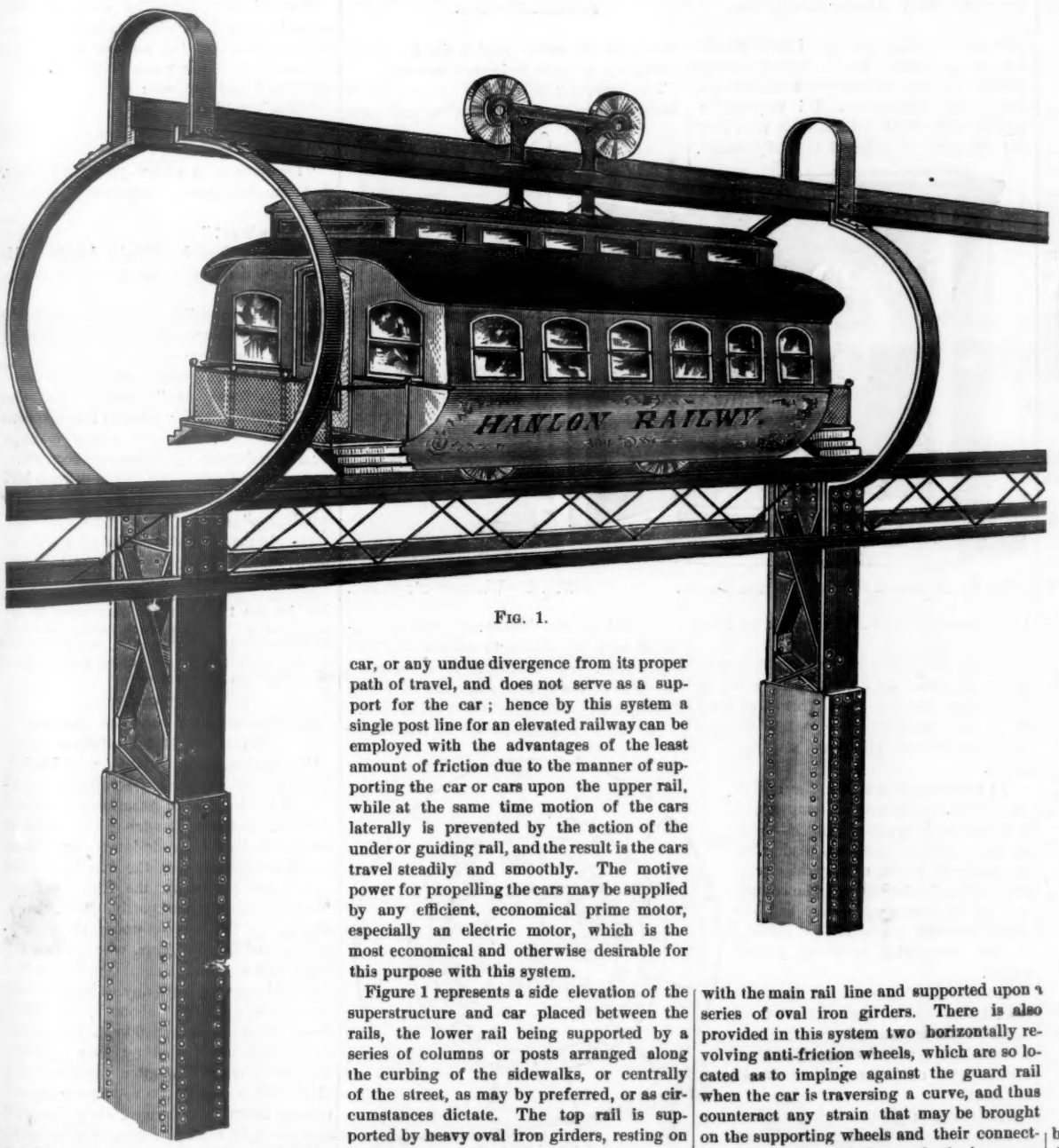

FIG. 1.

Figure 1 represents a side elevation of the superstructure and car placed between the rails, the lower rail being supported by a series of columns or posts arranged along the curbing of the sidewalks, or centrally of the street, as may by preferred, or as circumstances dictate. The top rail is supported by heavy oval iron girders, resting on and supported by said columns or posts. The uppermost of such rail line is heavier than the lower, since it is adapted to support the entire weight of the cars composing the train, and hence it must necessarily be adapted to resist the shocks and strains incident to the passage of the cars over the line, when actively operated by electricity; but if it is desired to use steam as a motive power, the weight of the cars can be easily and readily transferred or changed to the lower rail, while, if it is desired to employ pneumatics or compressed air as a motive force, the weight of the cars composing the train can be equalized between the upper and lower rails, so as to result in smooth and rapid transit. In rounding or traversing curves, and to prevent any tendency of the cars from leaving the rail, there is provided guard rails, which are arranged concentric with the main rail line and supported upon a series of oval iron girders. There is also provided in this system two horizontally revolving anti-friction wheels, which are so located as to impinge against the guard rail when the car is traversing a curve, and thus counteract any strain that may be brought on the supporting wheels and their connecting parts. One of these wheels is represented in Fig. 2, at a point midway between the top of the car and the supporting wheels. This system is not confined to the particular disposition of the guard rails on curves alone, since the right-hand guard rail shown in Fig. 2 may be introduced continuously along the line, with equally good results.

In traversing curves, it will be understood that each wheel of the upper and lower sets is not only journaled separately, but also capable of motion within a pivoted truck, as is the case in ordinary railway car trucks; hence it is obvious that each wheel will adjust itself to a curve of any radius, however small.

FIG. 2.

Waste of Fuel.

The wax of a candle is turned into gas before being burned in the flame. This may be proved by the following experiment: After the candle has been burning a few minutes blow it out and hold a lighted match in the smoke coming from the wick, and about one inch above it. The smoke (?) burns, the flame running down and and relighting the candle. What appeared to be smoke coming from the wick was gas into which the wax of the candle had been turned by the heat of the flame. Now hold a cold saucer in the flame. Soot or unconsumed

carbon will be deposited, because the gas formed has been cooled below the temperature at which carbon burns. The clouds of smoke escaping from many furnaces have led engineers to estimate the loss of fuel. In no case does the loss amount to more than a fraction of a per cent. of the fuel consumed. Many devices which prevent smoke increase the consumption of fuel. There is, however, a loss from imperfect combustion which may or may not be accompanied by large volumes of smoke. The coal may be partially burned, forming an invisible gas called carbonic oxide, which, if completely burned to carbonic dioxide, would give out in the furnace a large amount of heat otherwise lost. Just as the combustion of the candle flame is hindered by cooling so the carbonic oxide, unless the temperature is at the burning point, will not be consumed. The improved forms of furnaces, grate bars, and settings, have been devised with the view of supplying a sufficient quantity of air at such high temperatures that the fuel may be entirely consumed.

OUR ROCHESTER LETTER.

From a Special Correspondent of the ELECTRICAL REVIEW.

I always, on my travels around Rochester, Buffalo and Syracuse, learn something I did not know before; and when I do, I like to tell your readers what I know.

Rochesterans, you know, eschew the telephone. They, however, take hold of the writing telegraph; as many as twenty-five, I believe, try their hand, now and then, and I think the sentiment of one may express that of the whole—that it is a d———d nuisance. So is the telephone; but the Bell Company still exist, and make connections, when the need is felt, through public telephone stations.

The Buffalo branch of this company are preparing to lay down conduits, and have a grant from the Buffalo Council for the work.

The Sawyer-Man Electric Company have recently, through Schmidt, Koelber & Co., of this city, installed a plant in the Saxton & Thompson flour mill at Lockport.

Mr. Koelber, of the above firm, has been very ill for six weeks, but is now convalescent, and goes away soon to a milder climate, to recuperate. His friends wish him a speedy and complete recovery.

The Syracusans are, the 1st of July, to have a complete, new telephone service. The Central New York Telephone Company are building a complete outfit of new poles and central office attachments.

They have shown their foresight in erecting large poles (60 to 80 feet) and radiating cables from the central.

The central is provided with a W. E. multiple board of 1,000 capacity. They have about 700 old subscribers, and have added about 50 to the list, in view of the future service, which will be a great improvement. This exchange can, in many respects, be called a representative one. Mr. Girvin is the manager. Mr. Meyer's equipment remains in his hands. Nothing is known of his future intentions.

We sometimes hear wonderful stories of self-made men. I have a new one, and, as it is particularly pertinent to electricians, here it is:

"Boy, are you acquainted around here?" he asked of a lad on Michigan avenue.

"Yes, sir."

"I want to find the Civilized Cornice Works."

"Never heard of 'em."

"But it's an old concern, and I was told to come to this corner. There's a big sign on the roof."

"Oh, you mean the Galvanized Cornice Works. It's right around that corner."

"Bub, did I say civilized?"

"Yes, sir."

"And the proper word is galvanized?"

"That's it."

"Here—come here. Here's a dime for you, and you just keep mum about what has passed. I'm going to run for supervisor this fall, on the strength of being a self-made man who got his education by the light of a corn cob candle, and I don't want the infernal opposition to get hold of the fact that the candle went out on me too soon."

The Syracuse Electric Light Company (T. H.) are preparing to put in the Thomson induction system; so I understand. H.

ROCHESTER, N. Y., June 23.

The American Automatic Fire Alarm System.

The above system is in use in a large number of factories around Boston, including the Boston Storage Warehouse, F. A. Kennedy & Co. Cracker Bakery, Riverside *Press* at Cambridge, freight sheds, pier houses of the New York and New England

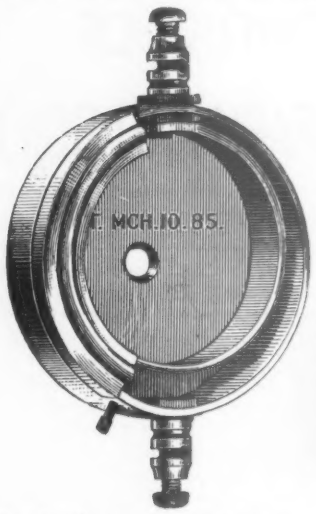

FIG. 1.—THERMOSTAT OF AMERICAN AUTOMATIC FIRE ALARM ASSOCIATION.

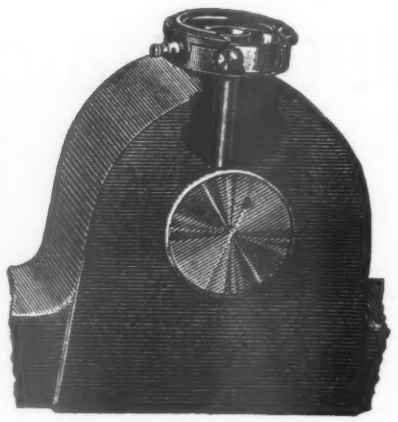

FIG. 2.—THERMOSTAT SET INTO JOURNAL BEARING.

Railroad Company, and the Lower Pacific Mills at Lawrence, Mass. The system has been in operation for two years past and has given perfect satisfaction. It is very simple, requires but slight attention—in fact, only that necessary to take off the daily record.

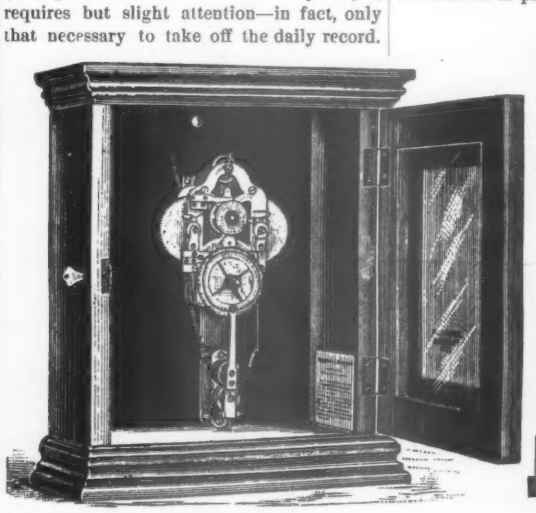

FIG. 3.—MULTIPLE CIRCUIT TESTING BLOCK.

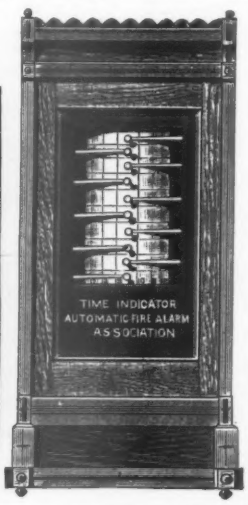

FIG. 4.—WATCHMAN'S CLOCK.

The thermostat and testing clock are illustrated herewith.

The thermostat consists of a shallow case about $1\frac{7}{8}$ inches in diameter, in which is placed the Bourdon spring (insulated from the case), composed of very thin German silver, partly filled with a very sensitive liquid.

As the temperature rises, the spring straightens, and when the temperature at which the instrument is set has been reached, a sliding contact is made with an adjustable screw, closing the circuit and sending in the alarm. The contact is made with great pressure, and the sliding contact prevents the liability of dust interfering with its perfect action.

The spring being insulated from the case, leaves but a small amount of metal to be heated before the alarm is sounded, thus making this thermostat one of the most sensitive in the market.

The multiple circuit testing clock is arranged to test from one to twenty circuits at one revolution of the dial, which takes about ten seconds. In practical operation this is done once a day, and if the circuits, battery, bell and all the instruments are in order, a perfect record is made on the dial. These small round dials, shown in Fig. 5, are dated as they are taken from the clock and filed away for reference.

The claim of this system is its great simplicity, there being but three instruments, and those of the simplest construction. The company is thus able to put up a plant of automatic fire alarm anywhere in the country, and to be able to know at all times the condition of the whole system by sending for a dial. Once every month a dial, stamped and dated, is sent to every plant, with the requust to use same at next test and report action of same, then return to the office. Under this system of testing, the interest of the parties owning the fire alarm is kept up, as it can be in no other way.

The company have now about 15,000 thermostats in practical operation, and have never had enough loss in any building protected with the alarm to call for insurance adjustment. The insurance men recognize the value of the system, and allow a liberal rebate on all buildings where it is installed.

The New England Insurance Exchange; the Boston Tariff Association; the Chicago Board of Underwriters; the Minneapolis, Minn., Underwriters' Compact; the Galveston (Texas) Board of Underwriters; the Texas State Board of Underwriters have all made reductions of insurance rates for its introduction, while the Manufacturers' Mutual Fire Insurance Company, of New England, the Manufacturers and Millers' Mutual Insurance Companies of the West, the Mutual Insurance of New York, have urged its adoption.

FIG. 5.—DIAL.

Electrical Twinks.

The older poets used to write about "Love's Halo." In this telephonic age the dapper rhymester gets off grinds on "Love's Hello."—*Burlington Free Press.*

It is suggested that the plan of executing criminals by electricity will give relations a chance to say that their luckless kinsman was struck by lightning.—*Philadelphia Call.*

GOOD VOICE FOR LONG-DISTANCE TELEPHONY.

There is a block in East Forty-fifth street whose inhabitants do not seem to appreciate music. The back parlor of a Forty-fourth street house is haunted by a fair young girl with prima-donna tendencies, and with open windows she carols nightly. She has a voice strong enough to raise a circus tent, and she permeates the block with melody. The trills from her young throat rise up and wrap themselves about the steeple of a Lexington avenue church and glitter like frost in the moonlight.

There was a concert of greater brilliancy than usual the other evening, and just as the strains of "Read the Answer in the Stars" were being wafted down the block a head came out of a Forty-fifth street back room, and the owner of it yelled angrily, "Hi! over there!"

Thirteen other heads of weary listeners popped out of back windows and after several repetitions of the remark an old man looked out from the room where the melody originated, and inquired:

"Who's calling?"

"I am."

"What do you want?"

"I only wish to assure you, my dear sir, that your daughter is competent to sail any day."

"Sail where?"

"To join Buffalo Bill in London. He needs new material in his war-whoop chorus, I understand."

"You are insulting, sir," said the old man angrily, and he was going to add something else, but there were symptoms of applause from the thirteen auditors, and he kept silent.

"No offense, sir," protested the first speaker pleasantly. "I am in the telephone business myself. We need a new manager for a long-distance telephone, somebody with a brass-tipped voice who can talk from here to San Francisco without effort, and if your daughter—"

The old man's head went in with some remarks that seemed to have a general application.

But there has been no more music since. One by one the cats are returning to the block and making it seem homelike and natural with their vesper hymns, and now when the moonbeams straggle across Long Island City they find only peace.

The Prudential Assurance Company's Electric Light Installation.

Our contemporary, *Industries*, of London, illustrates the following interesting installation of the Prudential Assurance Company, Limited, Holborn, London. The whole of the work has been designed by Messrs. Drake & Gorham, and the installation was carried out partly by the Electric Power Storage Company, and partly by Mr. Bailey, the clerk of the works, under the superintendence of the designers, who are now acting as the consulting engineers to the Prudential Assurance Company. The total number of lamps fixed is about 2,000 Edison-Swan 16-candle power 60-volt lamps; and the current is supplied by four dynamos. Two of these are Crompton machines, each giving 600 amperes at 80 volts pressure, and two are Siemens machines, each giving 200 amperes at 80 volts pressure. The comparatively low E.M.F. of 60 volts was chosen for the lamps, because, at the time when the installation was designed, no reliable 10-candle lamps of higher voltage were obtainable, and it was at first intended to employ only 10-candle lamps. The plant was, however, put down large enough to supply 60-watt lamps, and this change has been made, as 10-candle power lamps were found in practice to be insufficient for office work.

The total storage capacity of the cells is sufficient to work a thousand lamps of 60 watts for nine hours, for which output are fixed 528 cells of the 31 L type, made by the Storage Company.

The engine power consists of two horizontal engines of 35 N.H.P.; by Marshall, Sons & Co.; cylinders, 19in. diameter and 36in. stroke, arranged one right hand and the other left, and fitted with patent automatic expansion valve gear, the governors being driven by double belts. The pistons are fitted with tail guides, and special lubricating arrangements are provided for long runs.

The three boilers are of the locomotive type, and are constructed for a working pressure of 90 lbs., at which pressure each engine develops 110 horse power. The boilers are fitted with steam domes and Cowburn's safety valves.

The whole of the wiring is on the parallel system, and the main conductors consist chiefly of bare copper strip, run outside the walls of the building, and supported on special insulators designed by Messrs. Drake & Gorham. This arrangement for a vertical and horizontal conductor is shown in the sketch, Fig. 1. The branch cables are carried through the walls in boxes run in with bitumen, and are then soldered to the connecting strip, all these joints being protected with a roof to keep them dry. The insulation of this system has been found to be very good, and apart from the advantage of having all the mains in sight, there is, of course, a very great saving in cost. The wiring has been worked out on a basis of .6 ampere per millimeter (about 400 amperes per square inch) which was estimated to be the most economical, having due regard to first cost and loss in working.

The accumulators are arranged in tiers, and are coupled four cells in parallel throughout, so that each battery will give a discharge of 240 amperes by 60 volts. In practice, it has been found safe to connect two such batteries at the extremities in parallel, thus providing for 480 amperes discharge.

There are four distributing switchboards, fitted throughout with Drake & Gorham's ring contact switches, and their steel yard measuring instruments; and special terminal blocks are arranged as shown in the sketch, Fig. 2, which is a diagram representing the whole of the connections, to enable any dynamo and any set of lamps to be connected to any of the switchboards. Two four-way regulator switches are supplied to each board, one for the charging and the other for the discharging circuit, as shown in our sketch, so that the potential on the lamp circuit may be the same whether the dynamos are running or not.

The general arrangement of these inter changeable connections will be best understood by explaining in detail the connections representing the special case to which our diagram refers. As thus connected, it will be seen that No. 1 dynamo is charging No. 1 and No. 3. batteries in parallel, and that these are supplying No. 4 and No. 3 lamp circuits; dynamos 2 and 3 are not working, and dynamo No. 4 is charging No. 2 cells, which are supplying No. 1 lamp circuit; the battery No. 4 is not being charged, but is discharging on the lamp circuit No. 2. Battery No. 1 is discharging off 27 cells, and 31 cells are being charged; battery No. 2 is discharging off 31 cells, 27 cells being charged. It will be easy to see, from this explanation, how the connections must be altered to produce any other combination between dynamos, batteries, and lamp circuits. The system has been found reliable and easy to manipulate, and has fully complied with the somewhat exacting requirements of the installation. It should be noted that all the switches are on the negative circuit, and the fixed connections shown in Fig 2 are on the positive circuit. Thus the maximum difference of potential which can possibly occur on any of the switch boards is limited to the E.M.F. of four cells, or only about eight volts. The connections on the positive circuit, although spoken of as fixed for the purpose of distinguishing them from the switches, can be varied by means of bent copper strips, in the same manner as on the negative circuit. The battery rooms are shut off from the engine room, to prevent the rusting of the bright parts of the machinery, and damage to the insulation of the dynamos, from the acid fumes.

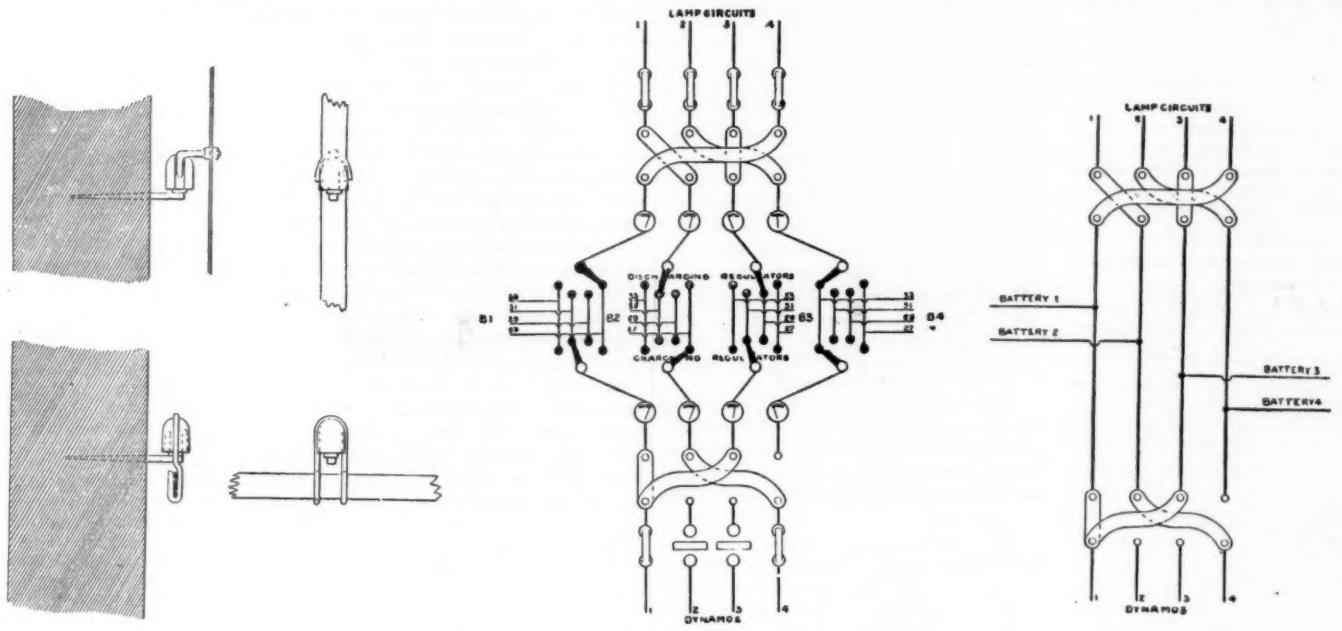

FIG. 2.—DIAGRAM OF CONNECTIONS, CIRCUITS, ETC.

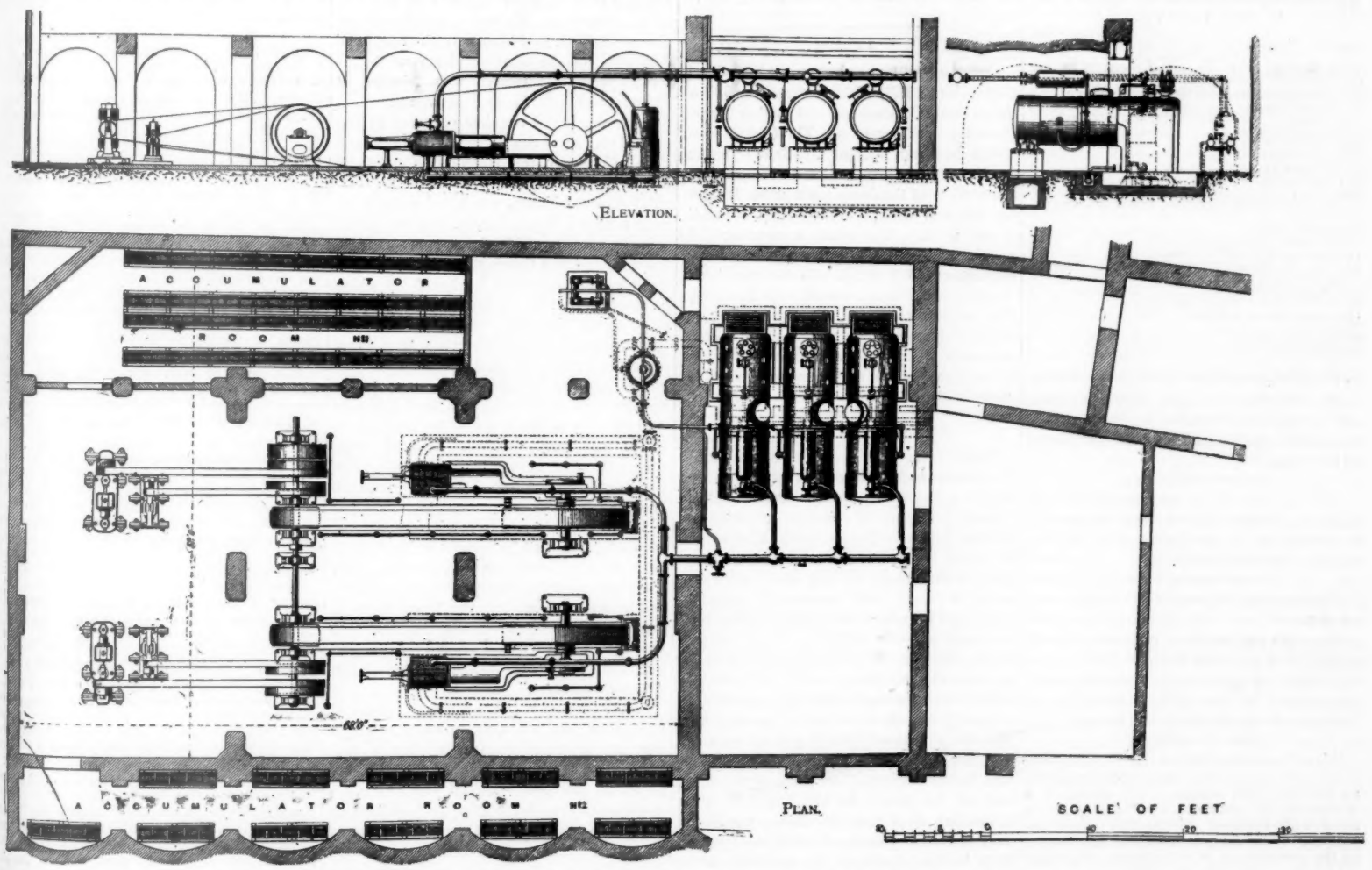

FIG. 1.—DIAGRAM OF PLAN OF ELECTRIC LIGHT INSTALLATION AT HOLBORN, ENGLAND.

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The daily papers are just finding out about the carbon combination, which was announced in the ELECTRICAL REVIEW several months ago.

The exhibit of electric motors at the National Electric Light Association meeting in Boston in August promises to be unusually large and interesting.

Rumors are flying around to the effect that a number of large local electric lighting companies have purchased an immense quantity of petroleum coke for future deliveries, and will form a company to manufacture carbons independent of the carbon combination, which has its headquarters in Cleveland.

There was a time when the building was thought to be the least important part of the an electric light station. The cellar of a storehouse, an old shed, were in some cases filled with valuable electric and steam apparatus. The danger from fire originating on the premises or in neighboring buildings was so great that the rates of insurance were prohibitive.

The damage to the business and the loss of confidence from stoppages due to fires has led to the erection of one-story brick buildings for electric light plants and far enough away from other buildings, or so well protected, that no interruption need be caused by fire. A method of construction cheaper than brick, and nearly as good, is to make the walls of 3-inch plank placed vertically and bolted on to cross beams.

In this issue of the REVIEW appear several interesting points on the earthquake.

The general improvement in the prices of electrical securities is an indication of the increased confidence of the public in the future of electrical enterprises. A careful conservative spirit is now growing among managers. The best method of conducting electric plants has been a study for some years, and the principles of successful management are fairly well known. The gas engineers, who twenty years ago were composed of men who each thought they alone knew the best secrets of manufacture, now meet often and exchange views on questions of common interest, in imitation of electric light engineers. Scores of regenerative burners have been brought out which were not lasting, much less regenerative. Imitation as far as possible of the features of electric lighting by the gas companies shows plainly that they have awakened to the fact that the public appreciate the good point of the new light.

The Governor of New York has signed the Brooklyn Underground Wire Commission Bill, but it seems that the telephone and telegraph companies of that city, which are all anxious to bury their wires, are to suffer further delay.

There will probably be a clash of authority between the Subway Commissioners and the Common Council over carrying out the provisions of the bill. Under an ordinance passed by the Common Council, City Works Commissioner Conner is directed not to grant permits for the opening of streets for laying or connecting underground wires without its sanction. The commission think that the Common Council has no jurisdiction in the matter and that Commissioner Conner is compelled under the law of 1885 to open the streets on applications indorsed by them. It is probable that the matter will be taken into court to settle the question of jurisdiction.

THE SUBWAY BILL SIGNED.

Governor Hill has signed the New York City Subway Bill, which extends the life of the present Commission and makes Mayor Hewitt a member of it. The Commission, which has been waiting for final action on the part of the Governor, will now order the completion of the down-town work laid out last fall, and will proceed to map out additional work. The Sixth avenue conduit will be extended south, and the cross-town conduit on 58th street will be completed. Another cross-town conduit will be laid in the neighborhood of 23d or 14th street. Work will commence at once, and a comprehensive trial in New York city may now be expected of an underground system for electric wires.

THE TELAUTOGRAPH.

Prof. Elisha Gray is said to be perfecting his telautograph, and soon expects to be able to send autographic messages between cities. The chief feature is the plate on which the writing is done. No particular kind of pen or pencil has to be used; in fact, a sharp-pointed instrument of any kind, or even a piece of wood, will answer the purpose. The paper on which the writing is done and the autograph reproduced does not have to be prepared, for in the first instance it is the pressure on the plate which gives the impulse to the machine, while the reproduction is brought about by a tracing point, which may be a properly-inked pen or even an ordinary lead pencil attached to a movable arm in the receiving machine at the other end of the line. At his Highland Park laboratory, Prof. Gray has made a number of very satisfactory trials of this invention, and he is inclined to think the machine will be demanded in all cases where absolute accuracy in the delivery and filling of an order is required, and that it will eventually supersede the present system of telegraphic communication; in fact, that an operator will simply transcribe a message, and, while in the act of so doing, will wire it to any point on the continent, the reproduction at the other point always being a *fac simile* of the writing of the person at the machine.

OUR CHICAGO LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

A Virginia City, Nevada, correspondent tells some funny yarns about the use of earthquakes as remedial agents. He was at Walley's hot springs, having the kinks drawn out of his limbs, when, with several other old petrifactions and stiffs, he was shaken up, with a not very gentle version of rock-me-to-sleep-mother, in the night.

The curative effect of earthquakes, he says, is abundantly and satisfactorily proven. Men who had been limping round for days, hardly able to put one package of foot before the other; men who thought themselves a failure as bipeds, and could only get around by the aid of two sticks, hopped out of bed, and sought the cool as readily as an old soaker with the "James preserves." Legs and arms that were crooked as ram's horns, or shut up like jack-knives, straightened as quick as the limbs of a three-base hitter, and supple as the muscles of a jack-kettle winner. One man, who for days had been carried from one bed to another, to the music of his own dying wail, super-saturated with highly artistic colors, and repeatedly encored, made a three-button run, and finished dressing in the yard.

The historian himself says he got home cured, two weeks earlier than had been arranged for.

The springs bubbled over with glee at the laughable spectacle, and in the exuberance of their joy have been overflowing ever since.

During a storm on the 18th the wind came up so suddenly as to catch several small boats out, in which young people were enjoying themselves. One of these, occupied by three young men, was capsized, and all drowned. Among these was Wm. B. Miller, an employe of the Chicago Telephone Company, a young man of good habits, well liked by all his associates. He was a member of the Kenwood Club, had been with the telephone company, in the contract department, for several years, and resided with relatives at Fifty-second and Washington avenue.

A peculiarly sad accident occurred at the central station of the Chicago Arc Light and Power Company, 188 Washington street, on Monday, the 20th. Mr. Chas. Moellar, their chief steam engineer, was killed while trimming a lamp in the coal room, near the boilers.

He had been outside doing some work in the rain, and was thoroughly wet. A barrel was placed to support a dry board, on which he stepped to trim the lamp. The supposition among his fellow employes is that the barrel, standing on an uncertain foundation of broken coal, tottered, and while still holding the lamp he lost his balance and touched the basement wall, forming a second ground—the first being the result of the heavy rain, which had hardly ceased. Medical assistance was called at once, but, although gasping when picked up, he soon ceased to breathe.

An excellent idea, which has resulted from necessity, has been elaborated by Prof. F. B Badt, of the United States Company here. The business of the company has so increased, and is so spread out over the broad acres of western and southern Christendom, that men who can be trusted are getting scarce, and plants are delayed for want of instructors and dynamo engineers.

So the professor has opened a school of instruction, and has a fine class of students who are studying electric lighting in this way. It is a labor of love on his part, but he enters the field with all the vim of a lieutenant of regular artillery (which he is, by the way), showing that he has forgotten nothing of the ways which belong to the demonstrator. The plan is well worth imitation by others.

J. H. Reid, G. W. agent of the Mather Company here, has recently closed a contract with the Coronado Beach California Company, to light the hotel at that watering place. The Hotel de Coronado will have four Mather dynamos, two of two hundreds, and two of three hundreds capacity, and these will be made to run 1,600 sixteen candle power lamps, combined as needed up to the dynamo capacity.

The Western representative of the REVIEW is an admirer of high art, and desires to return sincere thanks to the Electrical Club of Kansas City for a remarkably truthful portrait of a general superintendent, and a spirited and life-like leaf from the experience of one of Wallick's hustlers of years ago.

CHICAGO, June 27, 1887.

OUR BOSTON LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

The Waltham Gas and Electric Light Company are supplying 49 arcs and 125 incandescents. They have about 5 miles of poles set and wires strung for 7,000 lights. The station is equipped with two 45 arc light machines and two 200 light incandescent of the Thomson-Houston pattern.

The tests of a Weston motor on a box car at the Cambridge railroad stables are very promising. On Thursday of last week six miles were run, including severe grades and curves. At a regular meeting of the Cambridge Board of Aldermen a petition of the Cambridge railroad to operate cars by electricity was referred to the committee on roads and bridges.

An adjourned meeting of those interested in the formation of a Boston Electric Club was held at 3.30 Tuesday, June 21. The meeting was called to order by Mr. Frank Ridlon, chairman of the committee on formation, who said the object of the club was the promotion of good fellowship and of social intercourse among those interested in electricity. Letters of congratulation had been received from persons interested in all classes of business. The committee appointed had held meetings and had drafted a constitution and by-laws. The following named officers were elected:

President, Frank Ridlon; vice-presidents, W. J. Hammer, W. B. Hosmer, Thos. D. Lockwood, H. J. Pettengill; secretary, Allan V. Garratt; treasurer, Herbert H. Hustis; historian, W. J. Hammer. Executive Committee, the above mentioned, with the following—C. M. Ramson, S. E. Barton, B. S. Flanders, A. F. Mason, F. H. Sawyer, H. J. Denvers, Thos. Roche, —— Woodworth, John D. Gould, E. W. Rice, jr., A. F. Upton, C. J. H. Woodbury, William Brophy, W. I. Barker, F. M. Gilley. Membership Committee—A. H. Chapman, Alexander Robeson, M. M. Slattery, Leuw Smith, J. F. Moriarty. Entertainment and Reception Committee—P. H. Alexander, F. A. Gilbert, R. F. Ross, Dennis J. Herne, Samuel Sias, J. E. Talbot, George W. Adams. In absence of Mr. Garratt, Mr. R. F. Ross was elected secretary *pro tem.* Mr. Ridlon said that the only other subject to come before the meeting was the engaging of a suitable set of rooms, that the National Electric Light Association was to meet in Boston in August, and as the committee had the refusal of some rooms it would be desirable to decide at once. On motion of Mr. Flanders a committee of five was appointed with full powers to arrange and contract for suitable rooms for the club. The committee consists of Ridlon, Ransom, Chapman, Slattery, Ross.

In addressing the meeting Mr. Ridlon said the members of the club were working for a common end, the advancement of practical results in electrical work to promote better feelings between those interested in electrical pursuits, to discuss matters of interest and to increase the knowledge of the requirements to best promote the electrical interests of New England. With the help of the insurance men, we should hope for the advancement of electric lighting as a means of safety to property. We want cheap rates of insurance on manufacturing property, where electricity is used exclusively for lighting purposes. The Manufacturers' Mutual Insurance Company state that up to the present time they have not on the large amount of mill property they insure paid a loss on a fire occasioned by electricity. It will be advantageous to all interested that in this club electric light and insurance men may meet. There should be established an examining board of New England insurance examiners and practical electricians to examine and certify as to the competency of persons sent out to install plants. That such persons should receive a certificate, just as do steam engineers, and they should keep the board informed of their addresses, so that they may receive at once notification of any change in the rules. In this way the insurance companies may have the confidence to accept the report of the installing engineers and do away with trouble and expense occasioned by having to send a special examiner to pass upon the workmanship of the plant.

BOSTON, MASS., June 28, 1887.

PERSONAL.

Mr. E. T. Gilliland is regaining his health in Adrian, Michigan.

Stephen D. Field has nearly completed his immense electric motor.

Mr. J. F. Morrison is pushing the business of the Baxter Motor Company with his usual great energy.

Mr. O. E. Madden, vice-president of the Electrical Accumulator Company, is taking a much-needed and well-earned vacation.

Mr. Fred. A. Gilbert probably has more clear cash invested in electric lighting plants than any other individual in the country.

Messrs. Frank Ridlon and A. V. Garratt, president and secretary of the Boston electric Club, comprise an enthusiastic and capable official staff.

Mr. J. Chester Wilson, of Altoona, has been appointed Electrical Engineer for the Pennsylvania State-Building Commission—a most excellent appointment.

Dr. Otto A. Moses sailed for Paris on the steamer La Burgoyne, last Saturday, to be absent several weeks. Important electrical work called him abroad.

Dr. Geo. H. Benjamin has presented the Electric Club $500 worth of electrical books. The club's new house will be ready for occupancy the latter part of August.

President Edward H. Johnson, of the Edison Company, is not a personal believer in the eight hour law, as his work during long office hours is continued at his residence with unabated vigor until midnight. His recent two weeks' vacation, which consisted of a riding jaunt with a party of friends, was a healthful and beneficial change.

Mr. E. I. Garfield, secretary of the Thomson-Houston Electric Company, of Boston, was a New York visitor for one day last week. Mr. Garfield is one of the busiest men in electrical work, and for him to lose a day away from the great company of which he is the responsible and never-tiring secretary, is so rare an event that his New York friends had difficulty in believing their own eyes when he dropped in to see them.

J. N. Keller is a very busy man, his duties as general manager of the Electrical Accumulator Company, of New York, and the Super-Heated Steam Company, of Boston, dividing his time equally between these two cities. The scenery between Boston and New York, both by land and water, has become so familiar to him as to be very monotonous.

Mr. Frederick Swift, general manager of the Sun Electric Company, is also the owner of a fleet of whalers, and is now in San Francisco, looking after this interest. Mr. Swift is the owner of a handsome yacht, is a capable sailor, and on several occasions was fleet captain of the Puritan, which is owned by J. Malcolm Forbes, brother of President Forbes, of the American Bell Telephone Company.

It is related that a former chief of the Electrical Department of the Patent Office won a dinner from his associates, by wagering it on the practicability of a seemingly impracticable claim made in a patent application by Chas. F. Brush. The chief says there are two men who always thoroughly test and practically apply inventions before patenting them—Chas. F. Brush and Prof. Elihu Thomson—and on this fact he based his faith, and won in the above instance.

Prof. William A. Anthony, of Cornell University, is to be associated with the Mather Electric Company as consulting electrician, and will make his headquarters at the company's factory after July 1st. The Mather Company is to be congratulated. Prof. Anthony is one of the brightest men in professional or electrical life, a recognized authority in several branches of learning, and the REVIEW extends to him a most hearty welcome upon his entrance into more active connection with the rapidly advancing science of electricity.

A New Seismometer Described Before the Electric Club.

REGULAR MONTHLY MEETING AT THE SEASHORE — A PARTICULARLY INTERESTING AND VALUABLE ADDRESS BY DR. OTTO A. MOSES, FOLLOWED BY DISCUSSION.

The elements were strongly arrayed in opposition to the success of the first seashore meeting of the Electric Club. It rained hard and continually, and the prospects of an enjoyable visit to Coney Island, Thursday evening, June 23d, were far from encouraging. Notwithstanding this, some forty members braved the weather, and by various routes went to the Hotel Brighton, where a fine repast was most satisfactorily served at 6.30 o'clock.

The affair was informal and greatly enjoyed, the fine singing by Lieut. F. W. Toppan, and music by Messrs. James Godfrey, Stephen Holbrooke, and other members of the club, greatly adding to the pleasure of the evening.

THE ADDRESS.

The topic of the evening, "A new electric seismometer, for indicating the approach and direction of earthquake waves," was very clearly described in his address and illustrated on the blackboard by the inventor, Dr. Otto A. Moses. In his opening remarks the doctor said:

Mr. President and gentlemen of the Electric Club, I am very glad to say that the enjoyment that you were having in the last few minutes, while I have been adjusting my machine, has been of such a delightful character as actually to prevent me from adjusting it. Your laughter, and the shaking of the walls from the voices of the members, has been sufficient to prevent the delicate adjustment that I wanted to make, and it is only in the last minute, when there has been a comparative quiet, a little pause, that I have been able to make that final adjustment The instrument before you is intended to register the most delicate waves that progress over the face of the earth. They are not necessarily earthquake waves. They may be those waves that come from—and it is an old idea—the breathing of the animal—the breathing of the earth—because it has been discovered recently that there are regular pulsations of this earth. Now it is not an unnatural thing to suppose that we who in examining nature can find the most minute forms of life in a drop of water, may look for forms of life just as much greater than ours as we are than those animalculæ; so that these pulsations or waves that I speak of may be, without any very great stretch of the imagination, a breathing of an animal—not necessarily in the way that we breathe, but a pulsation indicative of life, for life is nothing but motion.

Before proceeding to describe the instrument by which I propose to register the direction and force of earthquake waves, it would be well to define what is an earthquake, so that we may intelligently consider the requisites of the seismometer or seismoscope by which its movements may be recorded.

Those greater or lesser movements of the earth that are felt, seen, or heard, and which are caused by either an increase or diminution of internal or external pressure on the outer layers of the earth, are called earthquakes. They are made evident to us by tremors and undulations of the earth and sea, by the destruction of buildings, the permanent elevation or subsidence of strata, the opening of fissures, the escape of gases, and flames from them, and in their most powerful manifestations by the flow of melted lava from the interior of the earth, accompanied by the escape of steam and clouds of dust and ashes.

It has been often said—and I myself have heard it from many eye witnesses—that an earthquake is something indescribable and never to be forgotten. Alexander von Humboldt, who felt a severe one in South America, paints it better than any other, while describing its moral effects in the following words: "The first earthquake we ever felt, left behind an unspeakably deep and peculiar impression. What so wonderfully affected us was the upsetting of our confirmed belief in the quiet immobility of the earth's solid strata. We have been accustomed from early childhood to hear the stability of the earth upon which we stand contrasted with the instability of water. Our senses have offered us every testimony, and have strengthened this belief. When the ground suddenly quakes, a secret power of Nature seems to be born that can loosen the very foundation of the earth. In the twinkling of an eye all this illusion of our whole lives is annihilated. We are undeceived about the quiet of Nature; and we feel ourselves transported into the realms of some unknown destroying power, and the solid rock on which we stand is no longer to be trusted." No wonder that science calls for some automatic earthquake register, when such an observer loses his faculties, feeling the uselessness of recording a passing observation of what seems to be the end of all.

Yet this condition of things is of very frequent occurrence on our globe, and if we could get some daily record of every part of its surface we would find that a constant inaction is going on between the *terra incognita* of the inner world and the superficial crust upon which we walk or sail. In fact, earthquakes belong to the every-day occurrences; but when we consider that four-fifths of the earth's surface is covered by water, it is scarcely to be expected that we can ever organize systematic observations over a regular and close network of stations. Indeed, the evidence of one and the same earthquake is very different at different times and places. It varies irregularly, from the foci to the extreme edge of seismic action, passing from the stage of concentrated convulsion at the epicentrum to the almost imperceptible tremors at the periphery, sometimes agitating the surface of the earth with a motion seemingly as great as that of the storm-tossed ocean billow, or sinking to that fineness of vibration that only the microscope and microphone can detect the disturbance. Yet the earth is never at rest. However, we will be able soon, with the advance of meteorological and seismological science to map the origin and progress of a large proportion of those disturbances of the earth, which men, from the remotest antiquity, have been inclined to look upon as beyond their power to measure or predict, or even as catastrophes beyond the power of Nature to control. Nevertheless, many of these manifestations of Nature in her angriest mood have been studied by self-sacrificing observers; and, thanks to the electric telegraph, they will hereafter be considered, without fear or trembling, at a distance, and with the same feeling of security with which a midnight observer watches the fiery flight of some earth-drawn meteor, as it hurries through his field of view.

A learned French scientist, Abaddie, wanted to get an absolutely tremorless surface by which to take the reflections of fixed stars, perfectly quiet, for certain astronomical measurements. In order to get that—as to the pure scientist time is no object—he constructed a cone of solid concrete, that was about 4 meters or 18 or 19 feet in height, but buried below the surface of the earth, and that rested on the solid rock. He there put a surface of mercury, which you know to be as unstable as anything can be, because there is no capillary attraction between the mercury and the enclosing walls. There seems to be a repulsion between mercury and other surfaces, so that the slightest movement communicates its motion to the mercury surface. He then put above that orifice cross-hairs, such as you see in telescopes, microscopes and other observing instruments. From that he projected a beam of light down on to the surface of the mercury. The light rebounded and cast a shadow on the cross-hairs, and that was over the opening about two inches on the surface, and to his surprise he never was able to get a quiet observation of the shadow of those cross-hairs. It never was at rest, and sometimes it would disappear entirely. There was some seismic action that he could not feel at all, that affected the surface of the mercury below so that he never could get that beam of light that he threw on the surface of the mercury to reflect back through the same orifice through which it came. There was always a tremor.

Any instrument or piece of apparatus for registering the approach of an earthquake, to merit coming into general use, must combine several qualities which may not be easily united. It must be accurate in registering the work to be done; it must be delicate; it should respond quickly to the slightest or the strongest blow; it should recover itself instantly, in order to be ready for another record; it should not be affected by inaction by the change of perpendicularity, while passing from the trough of an earthwave to its crest and back again; it should be small, cheap, portable, always ready to apply a force, yet consuming no power while waiting; requiring no attention, being self-acting and self-recording.

Attempts have been repeatedly made to supply a seismoscope or seismometer which would fill all these conditions; but they have met with only partial success, for this reason, that they have all been made to act directly, in measuring the disturbance of a force upon whose absolute constancy the instrument should depend for fulfilling all the conditions of accurate registration. If the disturbance of gravity be the thing to be measured, then the governing principle of the machine which is to record it should be other than the force of gravity—a judge should not sit in judgment on his own case.

A vast number of instruments have been constructed to give warning of the approach of earthquakes, the first one of which we have any written record being of Chinese origin. It was used in the year 136 A. D. Aristotle, however, long before this, had classified earthquakes accurately; and the elder Pliny had even sacrificed his life while studying them. But we have no description left us of the instruments they used in their study. The evidences of definite direction in the movements made by earthquakes are so numerous, where they have caused the destruction of buildings, that it was easy to devise simple forms of apparatus based upon the changes of perpendicularity in objects on the surface of the earth. Any body in unstable equilibrium, as a rod balanced on one end, can be made, by its fall, to show the direction of an earthquake wave. An instrument that has been used for a very long time in Italy, by the common people, consists of a suspended cord, three or four feet long, having a plumb bob attached, whose point rests on a bed of loose sand, and which marks the changes in the perpendicularity of the string, in the event of an earthquake coming from any direction, except from below. As this seismoscope was only intended for practical purposes, to warn the inhabitants of a town of approaching danger, it was not of much use when the danger lay just beneath them.

Another instrument consisted of a plate having eight little bowls (corresponding in position to the cardinal points of the compass) resting on it in a circle near the edge. An inverted saucer had its upturned bottom filled with mercury up to a horizontal plane, just above which in a parallel direction were eight little holes corresponding to the bowls. The slightest agitation of the whole arrangement would cause the overflow of some mercury through one of the holes, thus approximately indicating the direction of an earthquake movement. This apparatus, called a "Cacciatore," after its inventor, is still in general use in earthquake-stricken Italy, being cheap and easily constructed; but it is open to the same objection as the last-described and still simpler instrument. However, it has the merit of having recorded in a comparatively short period of time after its invention that out of twenty-seven earthquakes felt at Palermo in the beginning of the century, nineteen had a constant east to west direction.

A new class of instruments consists of a pendulum or pendulums, made to move slowly, being long and heavily weighted.

(*Continued on Page* 8.)

Telephonic News

*** The new central office of the Metropolitan Telephone Company, on Cortlandt street, New York, is rapidly approaching completion.

*** The Central Electric Company, of Chicago, is manufacturing a very high grade of pins and brackets, and is securing an excellent trade in this class of goods, as well as in general electrical supplies.

*** The very handsome *menu* of the first banquet of the Chicago Electric Club reached us last Thursday. As the banquet had been held on the 18th, we were not able to be present, and no doubt missed a very pleasant event. The banquet committee was Messrs. H. Ward Leonard, A. H. Brown and J. L. Barclay. The meeting was held at the Grand Pacific Hotel. The club now numbers 84 members.

*** M. Leon Esquille is said to have perfected an invention in electricity and photography. By speaking into a photophone transmitter, which consists of a highly polished diaphragm, reflecting a ray of light, this ray of light is set into vibration and a photograph is made of it on a traveling band of sensitized paper. Now comes the wonderful part. If the image of this photographic tracing be projected by means of an electric arc of oxyhydrogen light upon a selenium receiver, the original speech is then heard. It is evident that there is no limit to the development of this peculiar combination of methods.

*** For some time the telephone from Brussels to Verviers has been working on a new circuit between the subscribers of the city of Verviers and those of the Bell Company at Brussels. To get this result, the department of telegraphs of the State has substituted for the old conductors made of iron of the telegraphic lines a double circuit part of hard drawn copper, and part in phosphor bronze. The result has been very satisfactory. The transmission of sound between Brussels and Verviers, with the new conductors, is much clearer than the one between Anvers and Brussels by the iron telegraphic wires.

*** A miner named Robbins got a verdict at El Paso, Texas, against the Erie Telephone Company for $375, because of an electric shock given him by Belle Hepburn, one of the girls in the central office. Paul Keating, ex-Mayor of El Paso, is proprietor of a saloon opposite the central telephone office. He had two rings hung from the awning in front and at just the height to tempt one to "try his muscle" by drawing himself up by them Two invisible wires from the telephone office connected with the rings. When a man seized the rings to draw himself up, as Robbins did one day, the watchful Belle Hepburn turned on the current and fastened him to the rings. When he was released he had to treat the crowd in Keating's saloon. Robbins was so severely shocked that he was laid up for a month or more, and he brought suit for $20,000. Judge Falvey, before whom the case was tried, is said to have himself turned on the current which one day fastened a County Assessor to the rings. The Assessor was a witness for Robbins. The $375 verdict was not satisfactory to Robbins and he has appealed.

What Caused the Dry Cell?

To the Editor of Electrical Review:

I am employed by the Automatic Fire Telegraph Company, of this city, as an assistant inspector. While making an inspection of a local battery a few days ago, I came across a very curious phenomenon. In a certain house we have our system arranged so that when there is a sufficient temperature reached a thermostat opens, and that breaks a local circuit (which has all the thermostats connected), and sends an alarm. When I was inspecting the battery, I discovered that the middle cell was as dry as could be, while the remainder were in first-class condition. The batteries were locked in a good strong closet, so it could not be jarred, while on the bottom of closet one could see where the fluid had hardened. I examined the cell very carefully, and could see no crack, after which I made a new element, and to-day the cell is in as good a condition as it was when first set up. A blue stone gravity battery of six cells was used.

If you would be so kind as to allow me to beg space enough in your paper to have this fact published, and an answer to the above fact, I would be much favored.

A CONSTANT READER.

New York, June 24.

Electro-Deposition of Iridium.

In a patent recently issued to Wm. L. Dudley, of Covington, Ky., the inventor describes a process of depositing iridium, by means of which a bright, flexible reguline deposit is obtained.

The inventor uses either an aqueous solution of the double chloride of iridium and sodium or of the double chloride of iridium and ammonium, containing about two ounces of metallic iridium to the gallon, and acidified with about one-half an ounce of sulphuric acid to the gallon.

The solution of the double chloride of iridium and sodium is prepared as follows: The hydrate of iridium is dissolved in the least possible quantity of hydrochloric acid and evaporated in a water bath to expel the excess of acid. The residue is then dissolved in water, and an amount of sodium chloride is added sufficient to combine with all of the chloride of iridium present to form the double salt. The solution is then diluted to the required amount, so as to contain about two ounces of metal to each gallon of liquid. The required amount of sulphuric acid is then added, and the solution is ready for the electro-deposition.

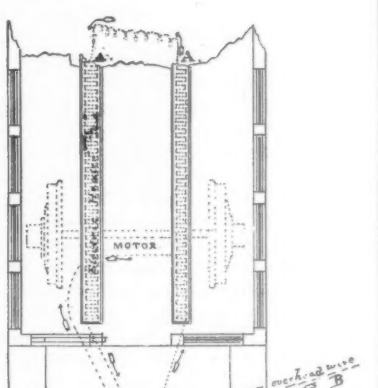


FIG. 1.—VIEW (LOOKING DOWN) OF THE BURTON ELECTRIC HEATER.

The solution of the double chloride of iridium and ammonium is prepared as follows: The hydrate of iridium is dissolved in the least possible quantity of hydrochloric acid, and carefully neutralized with ammonium hydrate. It is then acidulated with sulphuric acid until all of the precipitate produced by the ammonium hydrate is dissolved, and finally diluted with water until each gallon of the liquid contains about two ounces of the metal. The solution is then ready for work when acidified, as before mentioned.

From both of these solutions Mr. Dudley obtained a thick, bright and reguline deposit of iridium; and he has found that a plate of iridium or phosphide of iridium, as made by the Holland process, if used as an anode, will dissolve in these solutions while the current is passing.

As in electro-plating with other metals, it is essential, to obtain good results, that the articles to be plated should be perfectly clean. A brighter and smoother deposit is obtained if the articles are highly polished before they are introduced into the iridium bath. In plating articles which are readily attacked by the solution, it is, of course, desirable to first coat them with some metal not appreciably affected by such solutions.

In the deposition of iridium from any of its solutions, it is necessary to avoid battery power of too great intensity; and in case the intensity be too great, it can be recognized by the deposit becoming dark and powdery, and also by an excessive evolution of gas from the surface of the anode and cathode. In managing the solution, alkalinity should be avoided, although neutral solutions may be employed, but acid solutions are to be preferred.

During deposition, where a thick deposit is required, it may be found necessary to remove the articles from the solution from time to time, and to wipe them in case the deposit should have a tendency to become black; but this blackness may be avoided by proper manipulation of the solution and battery power, and also by proper cleansing of the articles. It is also found that when the articles to be plated are kept in gentle motion during deposition, the deposit will take place faster and be brighter and thicker than if they are allowed to remain stationary. Mr. Dudley does not claim, however, that the plating produced by his process will resist the action of acids which will dissolve finely-divided iridium.

The Burton Electric Heater for Electric Railway Cars.

This electric heater, for which a patent has been issued to W. Leigh Burton, of Richmond, Va., may be described as follows: It consists of an arrangement of wire—the resistance of which is controlled by its diameter and length—reflexed on an insulated base contained within a suitable casing, and having the necessary terminals, the wire being covered over with fire-clay or its equivalent. In this application of the invention the casing is preferably of metal with a corrugated top; the base consists of asbestos paper, and the wire, which is held in position by hooks placed near the outer edge of the paper, may be of German silver or platinum.

It is proposed to place two heaters in a car, each to be the length of the car inside—say 12 feet—8 inches wide, 1 inch thick, and resting on supports about 3 inches from the car floor. The radiating surface of the two heaters would be a fraction over 36 square feet.

The temperature of the heaters would be regulated by the resistance of the wires, the E.M.F., and the length of time they remained in the circuit; but the best results would be obtained by having the heater of such low resistance that when placed in circuit with the motor or motors, the working

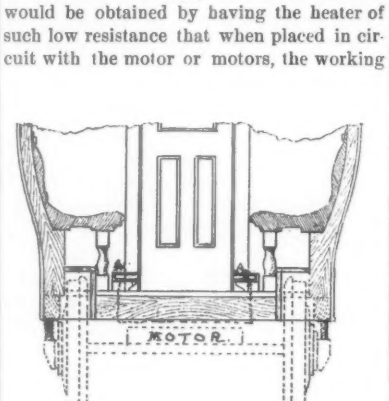


FIG. 2.—SHOWING ELECTRIC HEATER AS USED FOR HEATING STREET CARS.

efficiency of the latter would not be appreciably affected. In actual tests made with a heater of one-tenth ohm resistance in circuit with ten arc lights, it was found that the interposition of the heater had no perceptible effect on the brilliancy of the lights, nor was there the least "flickering" in them caused by its being rapidly cut in and out of the circuit; while in thirty minutes it attained the temperature that would ordinarily be required for a street car. The temperature of the heaters, however, would depend on the requirements of the moment, but the probabilities are that in no case would it be necessary to exceed 180° F. It should be stated also that the fire-clay contained in the heaters, although absorbing and radiating the heat generated in the wires, possesses the property of retaining the heat to such a degree that, should the current be cut off from the heaters when at a high temperature, the loss of heat would be scarcely appreciable in fifteen or twenty minutes thereafter Due regard being had to the proper insulation and connections of the heaters, their construction is simple and inexpensive, the employment of platinum wire in certain cases adding but a trifle to the outlay.

In the drawings, *A A*, Fig. 1, are parts of two heaters; *B* is the supply wire from the conduit or overhead wire; and *C* is a switch operated by either the foot or hand of the conductor by means of a crank above the platform. By following the direction of the arrows it will be seen that the current from the supply wire is caused to pass through the heaters to the motor, the heaters forming a part of the circuit; but when the switch at *a* is turned to the point *b*, the circuit to the heaters is broken, and the current is caused to go direct to the motor.

Fig. 2 is a cross-section of a street car showing the position of the heaters in front of the seats for the feet of passengers to rest on, or should this prove objectionable, how they may be placed out of the way under the seats.

OUR KANSAS CITY LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

The Paola, Kansas, Electric Light and Power Company has been incorporated, with a capital stock of $10,000. The directors are J. W. Sponable, J. F. Donahue, H. M. McLachlin, S. P. Boon and W. Freeland.

Hastings, Kansas, has secured the incandescent system of electric light. Representatives of the Thomson-Houston system have been in the city some time, negotiating for a system of both arc and incandescent lighting. Mr. Geo. B. Johnson, of Hastings, will have charge of the plant. There will be four dynamos, which will furnish 600 lights of 2,000 candle power. The power will be sufficient for eight dynamos.

An electrical phenomenon was witnessed by the guests of the Hotel Throop, Topeka, during dinner, one day last week. It was while a heavy rain storm was prevailing. Simultaneously with a vivid flash of lightning, nature's own dynamo suddenly illumined the incandescent electric lights in the large chandeliers suspended from the ceiling of the dining room. The lights glowed with great brilliancy for the space of ten seconds. Two or three of the globes were fractured by the shock.

The Orpheun, a music hall recently opened in San Francisco, is furnished with instruments placed in different parts of the room, and played simultaneously by electricity.

Last week the first electric motor, as applied to manufacturing, ever used in this city was placed in the factory of the S. D. Mills jewelry company. It has been running only a few days, but shows conclusively that it is going to be invaluable to those desiring a small amount of power.

After many days all difficulties have been surmounted, and the Kansas City Electric Railway, supplied with the Henry system of power, is in successful operation. There are two standpoints from which to measure the success of the system, *i. e.*, that of the general public and that of the operators of railways of all kinds. The people question concerning the speed and danger, while those interested in railway work look to the expense and cost of operation.

It is a general supposition that all electrical appliances as machinery carry more or less danger in connection with them, but in this case there is absolutely no danger to any one connected with the car in any capacity. An intensity of 1,000 volts is fatal to the ordinary man; 500 volts would probably be strong enough to kill an invalid. The power necessary for the electric railway never exceeds 250 volts, and can under no circumstances prove fatal, even though the full intensity of the shock was felt. There can be no danger in lightning, from the fact that the wires and motors are conductors and will carry off all surplus electricity to the ground.

The working of the motor is very simple, and such is the ease and readiness with which it can be handled that the car is under better control than on any other system. The rheostat, which is the same to a motor as a throttle valve is to a steam engine, is operated simply by the turning of a crank, and power is thrown on or off by a touch. The reversing of a small lever reverses the action of the motor, and so powerful is this action in connection with the brake that the car can be stopped within a distance of ten feet when going at full speed.

The road is operated by five dynamos, which are capable of running eight cars loaded. The dynamos are worked by an 80-horse power Ball engine, while a similar engine is held as a reserve.

The relative cost of equipment of the electric railway, and the cost of operation, as compared with the cable or horse systems, is the principal point of superiority, and as Kansas City now has the only electric railway in the world which is operated on a street of general traffic, this point has interest to all. According to the report of President Holmes, of the Chicago cable railway, the cost of construction and equipment of a

cable road is about $200,000 per mile, and they utilize 85 per cent. of the power to move the machinery and cable, and only 15 per cent. to move the cars and passengers. On the electric road 80 per cent. of the power is directly applied to the car, while the cost of construction and equipment is only $10,000 per mile. A calculation made on this basis shows that the cost of operation is about 50 per cent. of that of either the cable or horse system.

The operation of the road with only two cars has proved that the public will accept the mode of transportation, for the cars were crowded on every trip, and many were standing in the rain, waiting for an opportunity to ride.

It is the intention of the company to at once complete the construction of the road over the route held by the franchise of the old Fifth street railway, which extends from Fifth street and Grand avenue to Lydia avenue, thence north to the East Bottoms, thence east to the distillery. This road will be pushed to immediate completion, and it is expected that within a year it will be in successful operation for its entire length.

The buzzing of the motor is easily overcome, but at present Mr. Henry prefers to have the noise as a notice to people on the street.

Cars will now be placed on the track as rapidly as the new "motoneers" can be instructed in the operation of the motors. Four passenger cars are on the way from the factory, and the trains will be running in a few days.

Messrs. Samuel A. Bishop and Jacob Rich, of San Jose, are in the city examining the Henry electric motor. They are directors of the San Jose and Santa Clara Railroad Company, a horse car line which has been in operation 19 years. The road has decided to use an electric motor, and the directors are on a tour of inspection.

The Lindell Street Railway Company has also taken steps towards running an electric line. A Julien motor was attached to a car last week, and a round trip was successfully made. The dynamo in the company's barn is too small to charge the storage batteries as rapidly as is desired, and to remove that inconvenience a wire has been run from the Brush electric light plant to the car barn. The electric car is now used regularly. The company does not believe, however, that they will adopt the Julien motor as the mode of power of their line. They are now trying a Sprague motor, which, it is believed is more perfect. It swings between the axle and a thwart piece, and the interposition of a single pinion, working in a gear, will give revolution to the car wheel. There will be one gear engaged at each end of the armature shaft, which allows one to be fixed and the other adjustable. The motor delivers seven and a half horse power on its armature shaft, and there being one of these on each axle a fifteen horse power is furnished. At a recent meeting of the board of directors of the company the question of electric motors came up, and a decided partiality was shown for them. This is best shown by the fact that the board authorized the president to purchase five more motors.

An ordinance allowing the Metropolitan Street Railway company to extend its Twelfth street line has been passed, and includes a provision that electric lights must be placed all along the extension.

Mr. Warren Watson, secretary of the Electric Railroad Company, said in conversation with your correspondent the other morning, "The Kansas City Electric Railroad is beginning to make money. It costs us to operate the two cars now running about $30 a day. I can say confidently that this is the only electric railroad in the country that is running on a paying basis. With these two cars we carry daily an average of 1,200 passengers. We cannot run more cars now, on account of the delay of putting in switches. As soon as they are completed we will have all our cars running. It is all a mistake, the report that watches are magnetized on the cars. Of course if the passenger gets right over the works it will magnetize his watch a little." Since the road began operations, electricians and railroad men from all parts of the country have visited and inspected the plant, and have universally greatly admired it.

"The projected line to Denver and the Pacific coast will be built," said one of the gentlemen in the Edward Stokes party that visited the city last week, to your correspondent. "Mr. Stokes is here at present making definite arrangements to that end. Furthermore, the Pacific Mutual Telegraph Company, already a part of the Stokes United Lines system, is to be made the nucleus of a vast network of wire reaching northwest as far as Victoria, B. C., and west to Los Angeles and San Francisco. The Postal Telegraph Company is the eastern end of the system and changes in it are contemplated."

Mr. Stokes spent his time while in the city in close consultation with Messrs. Martin and Myers, president and superintendent of the Pacific Mutual.

Kansas City, Mo., June 18.

Kimball & Davis Electrical Apparatus.

The dynamo of this Boston company is of the Siemens type, built in sizes from 3 to 150 lights, either shunt-wound or self-regulating. It also may be used as a plater when con-

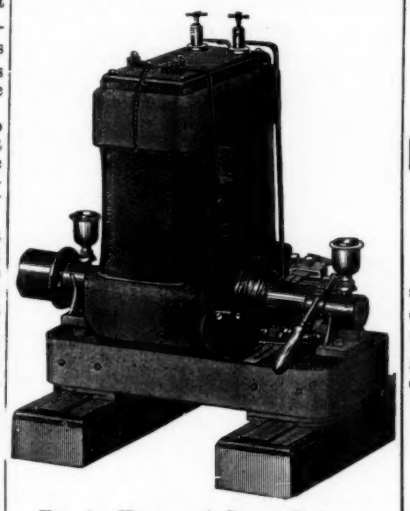


FIG. 1.—KIMBALL & DAVIS' DYNAMO.

structed for that purpose. A large numb are being used as teazers or exciters of alternate current machines, and for this purpose deliver from 1,500 watts upwards. These machines are being used for charging storage batteries, and for this purpose are made non-reversible.

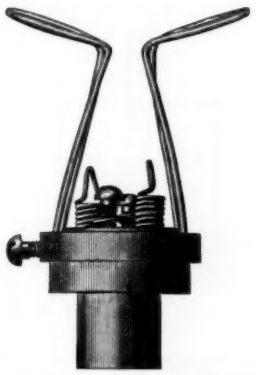


FIG. 3.—LAMP SOCKET WITH PROTECTOR.

Figs. 2 and 3 are sockets for battery and commercial lamps having looped back connections.

Fig. 4 shows the hanger board, which is quite simple, and will fit almost any lamp.

Machinery has recently been added to their already well-equipped factory for the pur-

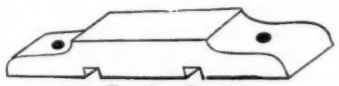


FIG. 5.—CLEAT.

pose of making all kinds of electrical woodwork, the cleats shown in Fig. 5, drop boxes, (Fig. 6) with or without fuses, fuse boxes for both loop and main line.

Fig. 7 is a lamp cage for use in places where the lamps are liable to mechanical injury.

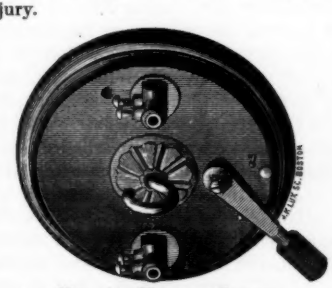


FIG. 4.—HANGER BOARD.

Switches of all kinds and special forms for storage battery plants in which a wrong connection causes considerable damage

—— In New York city franchises have been granted for the purpose of supplying electric lights to the American, the Waterhouse, the Ball, the North New York, the Harlem, the Mount Morris, and the Mutual Union Electric Light Companies. The Brush and the United States companies are the present occupants of the field.

Fine Electrical Work by E. S. Greeley & Co.

That very delicate instrument, the electric seismometer, described and exhibited before the Electric Club at its last meeting, required in its manufacture the most careful and

FIG. 6.

skillful workmanship. The electrical house of E. S. Greeley & Co., of this city, manufactured the instrument, and is to be congratulated on its success in completing an electrical appliance probably the most deli-

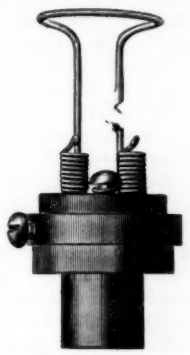


FIG. 2.—BATTERY LAMP SOCKET.

cate ever constructed, and for which there was no precedent to guide the electrical worker. The little seismometer will be of great scientific interest and value, and the

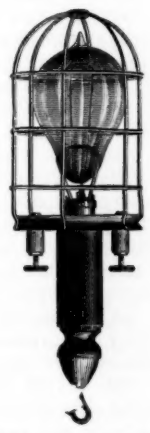


FIG. 7.—LAMP CAGE.

skillful electrical workers of E. S. Greeley & Co., who so successfully carefully carried out the ideas of the ingenious inventor, Dr. Moses, are entitled to great credit.

Lightning Rods in a Storm.

Herr Schiller, a well-known German architect, reports some facts of interest, as indicating the radius of the circle of protection of good lightning rods. On June 17 last, at the village of Montingen, lightning struck a pear tree 33 feet high. On one side, 115 feet away, was a schoolhouse, with a rod 56 feet high. On the other side was a church, 328 feet away, having a lightning rod reaching up 154 feet. Both rods are well placed and had worked well when tested, and the level of the foot of the tree is about the same as that of the two buildings. It is evident, then, if the facts have been accurately reported, that the radius of the circle of protection is not more than twice the height of the rod.

To sharpen razors, place in water to which has been added $\frac{1}{10}$ of its weight of hydrochloric acid, remove after one-half hour, wipe and rub upon hone. The acid acts like a whetstone and corrodes the whole surface uniformly. The process never injures good blades, and often improves bad ones.

TELEGRAPHIC

.... The lines, instruments, etc., of the Arkansas Telegraph Company, operating between Little Rock and Pine Bluff and Hot Springs, have been sold under an execution to the St. Louis, Iron Mountain and Southern Railroad Company. This company formed the Little Rock, Hot Springs and Pine Bluff connection with the Baltimore and Ohio lines, and has been in operation nearly two years.

.... A most extraordinary event occurred recently to a farmer living in Cundinamarca. He was in the fields, and was returning home, when he was surrounded by an electric flame, which disappeared as quickly as it came. The victim's left eye was damaged, and the eyebrow was burned completely off. The hair surrounding his ears, a portion of his beard and all the hair on his breast were burned off; all the brass buttons disappeared from his clothes; his watch chain was cut in two; a small hole was bored through his watch case; the watch glass was shattered, and his right side was burned. He suffered severely, but is recovering.

....Talk of the consolidation of the Baltimore and Ohio, Postal, Pacific Mutual and connecting lines of telegraph continues. B. R. Bates, superintendent of the Baltimore and Ohio lines in the West and Southwest, states that he does not believe that the Baltimore and Ohio intends to sell. Chris. Dougherty, Western manager of the Postal Telegraph Company, states that the Baltimore and Ohio Telegraph Company has had its plant and franchises on the market for some time. Should Gould purchase the Baltimore and Ohio, the Postal would build lines at all points now covered by the Baltimore and Ohio, and not covered by the Postal.

....Prof. Palmieri has recently presented a note to the Academy of Sciences at Naples embodying the results of a study of the so-called dry pile of Zamboni, extending over many years. He arrived at the conclusion that, provided only that care be taken to shut the battery in an hermetically sealed case, the difference of potential will remain absolutely constant for an indefinite period. It is not even necessary to employ any artificial means for drying the air. If the atmosphere remained unchanged this is quite sufficient to ensure the constancy of the pile. The presence of a slight trace of moisture is, in fact, favorable to the development of a higher E.M.F., without impairing its constancy. Prof. Palmieri considers that for maintaining an invariable charge in an electrometer the dry pile, under the above conditions, is far superior to the usual Leyden jar and sulphuric acid arrangement.

....Car No. 54, Cambridge Railroad Company, is being fitted with electric motive power. The batteries (Julien) are put under the seats. The light circuit is independent from the power circuit, and is composed of eight cells. Five 16-volt lamps, three overhead and one at each bullseye, light the car so that reading is a comfort. There is an electric bell at each end, run by the same batteries. The motor is a 5-arc light Weston dynamo, intended for 125 volts and 18 amperes, and is attached to the frame of the car underneath. The car is reversed by throwing a different set of brushes in contact with the commutator. The armature pulley and counter have four grooves, covered with leather; four endless spiral springs transmit the power. The other end of the counter has projecting teeth, which engage the links of an endless chain of the same pattern, used in tricycles, yet larger. This chain is kept taut by an idler pulley, and drives both axles of the car. The tests, so far, have been entirely in the line of experiment to solve the problem of the best method of applying the power to the driving wheels.

A NEW SEISMOMETER.

(*Continued from page 5.*)

These are unsatisfactory modifications of the first seismoscope, and have nothing to recommend them over the first one of the series except their adaptability to making a permanent register. They were, however, an important step towards the introduction of another class of instruments, which has opened up a fertile field for inventors. These efforts have led to the construction of the so-called "dead-beat" pendulum, invented by Mr. Thomas Gray, of Glasgow, to whom we are indebted for many ingenious and original earthquake-measuring and registering instruments, in which the movements of the pendulum are purposely retarded, and finally have culminated in the bracket seismograph, founded on the principle of Zöllner's horizontal pendulum.

You are all, of course, familiar with that experiment [illustrating] of inertia, the movement of a body under a surface at rest, where there is not sufficient friction to carry the body on the surface. This would be carried forward; the other body would fall. Now, that is the principle of the most successful seismoscopes and seismographs in use to-day. They have a very heavy weight. Of course, that weight is a little world in itself; it tends to the perpendicular, while the earth underneath it, which is drawing it, being, of course, drawn by the pendulum as well—the earth underneath it attracts it, and keeps it steady. If there comes a convulsion which moves it, the pendulum remains; and if, on the surface, you have some bristles, or a bit of paper which rests on a surface, blackened with lamp black, as the earth moves it will indicate by its movement the extent that it has moved. But that is only somewhat of a makeshift, because the pendulum, after a while, gets the motion of the earth. It is drawn with it, just as, if you revolve a wheel in water, the water is taken with it; so that all those different forms of apparatus are very unsatisfactory. It is a problem of great importance, and one that a great deal of ingenuity has been spent on; but none of these machines are satisfactory, because they register only very small motions, and the earth, gentlemen, may be moving through space fifty or a hundred miles, and you will not notice it; that is, you may move up or down fifty or a hundred miles, and you won't know it. Now, that seems like a broad statement. You would say things would be upset. Not a bit of it. Suppose I had a bridge, 8,000 miles long from parapet to parapet, taking the antipodes of the earth, and imagining the section of the earth to be a bridge. Now, then, a pressure of fifty miles down and fifty miles up, on such a bridge, would not be a hundredth part of the expansion that takes place every day in the Brooklyn bridge, which rises and falls several inches. You will say, we would feel strange. Well, do we feel strange when the people underneath us at the antipodes are enjoying the meridian sun—do we feel strange because we are upside down? Not a bit of it, because the attraction of the earth is so great that our blood rushes to our feet, and we do not know anything about it. So we would not know anything about a movement of fifty or a hundred miles on the earth, if it took place. Now, all these different apparatus are unsatisfactory, because they do not register the great movements in the earth that are taking place, that we may be entirely ignorant of. There is something which may be interesting just here.

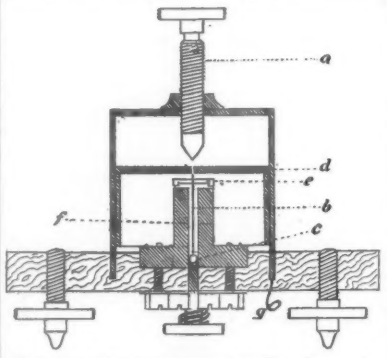
The first conversation that I ever had with Mr. Thomas A. Edison was on the subject of this seismoscope. That was in 1878. I met him one day at Mr. Prescott's office in the Western Union building, and I carried a letter of introduction to him from Dr. Agnew, a mutual friend. We got in conversation and I spoke of this and he was very much interested in it. I had combined with it a feature, that I will afterwards speak of, that required me to use some of the carbon that he was then experimenting with. He was just making a seismometer, and he accompanied me over to Menlo Park. There I experimented with this machine. I wanted to find out whether it was possible to register the varying pressure of the carbon and to make a registering instrument of a varying current of electricity to pass through the carbon, and one of the assistants in the laboratory said to me, "Here is a very curious thing I cannot explain." "Well, what is it?" He had a little carbon button such as those in use in the telephone, and there were very few of those buttons then, because he had not yet put the telephone on the market. Those buttons were all put under a weight of one gramme. Then a certain current of electricity was sent through it, and if the resistance was about one ohm, the carbon button passed muster, and it was then used and put into a telephone. If it did not pass muster, it was rejected. This gentleman, Martin Force, one of Mr. Edison's assistants, said to me, "I cannot understand this. I have been bothering over this button for an hour, and at one time it registers more, and at another time it registers less." It was a cloudy day, and I said, "Perhaps it is absorbing moisture. He said, "No, it is not so, because it has been the same kind of a day all day, and this morning it registered so much, and at noon it registered more, and to-night it will register still more" Well, I thought that thing over a long time and then it struck me that perhaps that gramme weight that he had on the surface of that carbon button did not weigh a gramme every time—every minute in the day; that may be it weighed three-fourths of a gramme at one time and a gramme and a half at another time. It would seem as if that was a question that could be easily solved; that you could weigh it on a balance. Well, what would you balance it with? You would balance it with a weight that varied in the same way, wouldn't you? Therefore it would be impossible to tell the difference. We could only surmise there was a change of weight, but it would be impossible to observe the change of weight unless you brought another force than gravity into play. Now I thought here was this carbon button that under this varying pressure allows a varying current of electricity to pass through it. Well, it would seem as if that would be something easily determined, and Mr. Geo. A. Hamilton at that time was very anxious to have me try experiments. He put the elevator of the Western Union building at my service, and I tried the same thing on the elevator at the Stevens Institute, and could get no results at all on account of the moving masses of metal. Therefore I had to give it up, but I think still, gentlemen, that that variation is caused by the variation in the weight of the object, and that the earth may be every day moving itself fifty or one hundred miles and changing the weight of bodies on its surface without our being able to know it.

A very complete apparatus, containing all the refinements necessary for permanently recording horizontal and vertical motion and the time of their occurrence, has been invented and operated by Messrs. Gray and Milne, and has been perfected so as to show the smallest changes of level. Indeed, by means of it they have registered the slight waves of motion that traverse the earth at long intervals, and which are known as so-called "earth pulsations."

All of these instruments are open to the objection that their registration of movement must be inaccurate, since they depend upon gravity to indicate them; for the movement of the earth, which they are intended to record, is itself an alteration of gravity. Nor can we ever hope to get an exact record of an earthquake until we can place our instruments alongside of the lever, by which Archimedes would lift the world, and then we might obtain in one record all the phases of movement by which the face of this earth is contorted or convulsed.

The operation of the instrument which I have the honor to lay before you to-day is based upon what might be called a new principle. It is proposed by its means to suspend a body in stable equilibrium, and yet to almost entirely abstract it from the influence of gravity, and to control it by a force (as far as we know it) independent of the action of gravity. It consists, briefly, of a straight piece of soft iron, a little thicker than an ordinary sewing needle, and about an inch long, which rests perpendicularly on its point, and is acted upon by a straight permanent steel magnet, whose axis is a continuation of that of the needle. The magnet is brought down gradually, so close to the needle that the latter is ready to fly upward into contact with the magnet upon the slightest diminution of the force of gravity ordinarily acting on the needle, by which it is retained in position. This effect is brought about by the slightest check or blow. The needle is never allowed to come in contact with the magnet, but with an interposed piece of brass by which an electrical contact is brought about; the instrument can thus be made to register any earthquake blow coming from any quarter of the compass, including an upward blow.

Now, I have here the seismometer, which we will dissect. The needle has a little disk of platinum upon it to give it weight and for making contacts. The permanent magnet above has a thread cut upon it. There is a thumb-screw upon the magnet, with which it can be brought down until the needle is just ready to fly. The lower point of the needle rests in a little globule of mercury. That cup is made of platinum, enclosed in copper. This little globule of mercury remains in there, and the needle is balanced on its surface. A wire connects with the cup, and leads to one pole of an open circuit battery. Above that needle, and interposed between the magnet and it, is an inverted cup of solid brass, connected through a register to the other pole of the battery. The cup is to serve as a surface, against which the needle, in its rise under the shock from below, comes in contact. The mercury globule below gives sufficient play for the needle to rise, so that when it comes in contact with the copper cup the circuit is closed. There is not a variation of a hundredth of one per cent. in the electromotive force if you do not disturb it. Make your experiment, and you will get a very constant electromotive force. But if you put it on a closed circuit it deteriorates very rapidly. As you observe, this copper vessel is interposed between the needle and the magnet. Any movement of the needle will cause a current of electricity. Therefore, that copper disk between them serves as a damper. You all recollect that the retarding action of a copper disk on a magnetic needle led to the elucidation of all those wonderful laws with reference to electricity upon which we now thrive. Arago found that a needle oscillating a certain number of times in a minute would diminish the number of its oscillations by the interposition of a disk of any substance—water, copper, glass, anything; and that led Faraday to try whether the movement of a mass of metal in the neighborhood of a quiescent magnetic needle would not cause the needle to move, and he found he could make the needle move as fast as the copper moved, inducing the current of electricity which reacted on the needle and set it in motion. Now, that is what we have here when we interpose the cup of copper. The movement of this mass elongates and contracts the lines of force like so many india rubber threads. I have heard them compared to threads of india rubber, and it is as good a simile as I ever heard to indicate what the action of the lines of force is—assuming for the sake of illustration india rubber threads trying to contract all the time. Now these threads cut this copper. The copper of course is permeable to the magnetic action and a current of electricity is induced which reacts on the needle and makes it stable, so that it stands there absolutely quiet. But it is prepared to respond with the slightest movement from any direction. Now I have the magnet brought down to a certain point, and I have a screw by which I can adjust the point of the needle below, and I can bring the magnet down to a thousandth of an inch and in that way regulate the attraction to the greatest nicety. So delicate is it that I was trying to adjust it for a quarter of an hour without success. The vibrations of the voices in the room were enough to disturb it and frustrate me. Now I have it adjusted and you will see the action of it. (Illustrating.)



ELECTRIC SEISMOMETER, BY DR. OTTO A. MOSES.

a, Permanent magnet; *b*, needle; *c*, globule of mercury; *d*, copper cup; *e*, platinum disk; *f*, copper segments; *g*, connection from copper cup.

You see the slighest touch on the table causes the needle to ascend to the copper disk. It comes in contact with the disk, thereby closing the circuit, and the upward blow is registered. There is underneath the disk a thick copper tube that is divided into eight segments, each covered with a sheet of platinum. Each segment is connected with the register, and will indicate the direction of all earthquake waves, except those from beneath, which are indicated as heretofore described.

Now, gentlemen, that describes the seismometer, and those who wish to see it if they will come forward I will dissect it and then they can see its action and can experiment with it. (Applause.)

THE DISCUSSION.

THE PRESIDENT: I know that you will all heartily second me in thanking Dr. Moses for his highly interesting lecture. I think it has been one of the most instructive papers that we have ever had read before our club. I have no doubt that Dr. Moses will be very glad to answer all questions which may be asked him in reference to the subject which he has presented. The paper is now open for discussion.

MR. DUTTON: The company with which I am connected has a telephone exchange at Charleston, S. C., where earthquakes have recently occurred, and I believe the general impression of the people in that place was that the wave was not in a regular movement. It was known that the early part of the earthquake movement seemed to be one way, and at the same time it seemed to be another way. This was demonstrated by the fact that one side of a building on one side of a street was entirely dropped down—the entire front of the building was dropped off—while the same thing occurred on the other side of the street. One shock had a tendency to equalize the other, so that the pulsation of the earth, which had thrown the front of this building off, by all natural reasoning would throw the back of the building off on the other side of the street. But, as a matter of fact, right down through the principal street—and I have in my office some photographs or pictures, taken immediately after the earthquake—they show that the entire fronts were thrown down. The theory was that it came northeast and southwest, and it sort of mixed up a mess of 'quakes, to settle underneath Charleston and topple the buildings all down promiscuously. I would ask the doctor whether that seismometer of his would notify us whether it was coming down the street or up the street? I haven't put that quite scientifically, but the doctor will understand it. [Laughter] With all respect, I want to make that known as the expression there of the people. Now, some of the telephone subscribers said they stood in their back yards and saw it "a-coming this way." Another man says, "You're mistaken; it came the other way." Now, whether it is a fact that these pulsations, that all came together, one on the northeast and the other on the southeast, would not

paralyze your machine to that extent that it wouldn't work at all, is the great question. [Laughter.]

DR. MOSES: Now I am very glad that that very salient point of advantage in the machine has been brought out in that way. They say, gentlemen, that ridicule is the test of truth, and I am very glad that the speaker paralyzed us all for a minute so that we might react from it. The advantage of the machine is that it is not put in position or operated by gravity. Gravity is the thing, you see, that gets all upset.

MR. DUTTON: They haven't seen any gravity down South.

DR. MOSES: Well, it has been a very grave community. The machine might be set off at an angle of 25 or 30 degrees without affecting its delicacy in the slightest degree; because, mark you, the needle follows the magnet and everything is relatively the same. It has to oscillate to one side or the other, so that if an earthquake wave were to be a force in that position, and then in that position, it would still register the direction from which it came. Now that peculiar effect which you speak of is brought about in this way. You have all been at sea, or in a lake, or in a river in a boat, when there is a roller coming from a steamer passing, you will find yourself going up and then coming down; but you will go up in this direction and you will come down in that direction, and yet the wave of that movement has come in one direction and finally breaks on the shore in a series of waves. That shows you that as the boat is on the crest of the wave it may be in its normal position; but when it is on that side of the wave it is so, and when it is on the other side of the wave it is so, so that you apparently get waves in opposite directions, and yet they are the same wave. The particles of water simply rise and fall; and in the earthquake the movement is one of migration of a wave of motion. I think myself it is due to the attraction of the sun and the moon which come in conjunction, or the so-called syzygies, and that like on our flood tides, or what they call great tides, that occur over and above the spring-tides, the earth is drawn up by those two in conjunction and forms an elevation, it may be fifty or a hundred miles, but we do not know it. We can only reason this out. And then as they pass out of conjunction it diminishes, and that gives that onward motion. Of course as the earth revolves, this motion which has been given, the drawing up of the earth in that direction, is continued and that passes around the earth in a constant regular motion—this so-called earth pulsation. Now if the speed of an earthquake is about, as it has been calculated, all the way from 1,500 to 10,000 feet a second—if you give me those limits I will hit exactly a speed that will carry it around the earth in 24 hours.

MR. DUTTON: There is one thing I meant to mention—that was, fissures in the ground, at Charleston, where they threw out this colored sand, which is now being manufactured in New Jersey and sold all over the the country as the "earthquake sand." [Laughter.]

DR. MOSES: Yes, I have some of it.

MR. DUTTON: I wanted to say there were two fissures; one was a larger one and the other a smaller one; but they came together. That is to say, they threw out the sand, one in one direction and the other in another direction; the sand lay out upon the ground in one yard from where some sand was sent to me as being the original. It was stated that the first sand was thrown over quite a distance; the second not quite so far, as it reached down into the ground a shorter distance. But there was a singular thing that they could not exactly understand, that these two principal fissures which threw up the sand in any quantity were toward each other, and the inference was that where the movement of the earth was in any particular direction that it seemed to them that it had come from down South or up North, or that we had originated it here in New York and sent it down there to get square with them—something like that. But this coming together, apparently, was something that they could not understand.

DR. MOSES: In speaking of the action of that sand, I want to say that I have a theory. You know everybody has a pet theory, like a pet lamb. Well, I have a pet lamb, too. Now, right under Charleston is a quicksand, about 2,050 feet down—the water-bearing strata that supplies the water of Charleston. When that well was struck—I happened to be living opposite it on the green, one winter when I was in Charleston—it began to pour out 300,000 gallons a day, out of a three inch hole, and it very soon flooded the lower portion of the green with a sand such as you described, so that it got to be a bore not only below the ground, but above the ground. They took hundreds of cart loads every day away from there. Now that quicksand must have come from some place. Wherever it came from it left an open space, very likely, and there we have an opportunity right under the city for the accumulation of a large amount of water in a reservoir, just as in these driven wells there are reservoirs that form under the earth; so that from this taking out of the quicksand there was left a large cavern. Now that cavern may have had its sources cut off for a while and then it would have been exhausted. Then, all of a sudden, there would have been an entry from some other similar cavern. These caverns may communicate subterraneously and the influx of water under enormous pressure into this reservoir may have been sufficient to raise a crack in the earth from that point right up. There we have the focus of action—the raising of the earth there and the settling of it again would be enough to communicate itself to a solid mass for five hundred or a thousand miles, just as when a locomotive strikes on the end of a rail five miles from here I can hear it. Just so that power acting on the earth would have its effects communicated an immense distance. Now that is merely my pet lamb. Mr. Price asks with regard to the communication of these motions, whether it would be possible to preserve ourselves by the registration of an instrument of the kind I have here to-night. I will say this—the very thought that suggested that instrument came from a similar question. It was invented in embryo when I was a student. I had a companion who used to go out to the mines with me where I was studying. He came from Chili and he was talking about earthquakes in that country, and he said there was only one thing that prevented the progress of the country. It was a fear of the repetition of those earthquakes that came from below. They never could get any indication of their coming, and the result was that they always lived in terror of their approach; and that was the origin of the devising of this scheme for registering the upward blow. Now an earthquake is always preceded by a tremor. It is probably the equivalent of what is called the critical point in boiling. There is a tendency to disrupt. It is like the clink that you hear when you scratch a glass tube and it is ready to break. There is a tension of the particles, and that tremor comes from just getting ready to show off what sort of power nature has.

Then after that gets through there is the blow—or some preparatory symptom again, but of a stronger character—and that is always followed by a convulsion, if it has any other effect. You will have some premonitory warning in the tremor. The instrument is so cheap that you might have in each observing station half a dozen instruments set to different degrees of delicacy, so that you could get all these tremors. But at any rate people would be prepared for the emergency and if they knew these tremors came from below they could get out of their houses and into their cellars and into places of refuge, and thus escape the danger.

There is one remark made about one side of a house falling and the other not falling, which recalls something I have heard with regard to the city of Caraccas, which of all cities on the face of the earth seems to be the one most accustomed to earthquakes. They have in Caraccas what they call the safe side of the house, because all the quakes come from pretty much the same direction; and there they have what are called earthquake coats, that is, a coat provided with some provisions, with water, and some things of that kind that they might need in an emergency, hanging on the walls; because people don't think when earthquakes come along. I was told by a cousin of mine who was in this earthquake in Charleston of what the condition of mind of the people was. You can't imagine it. I think this may give you some faint indication of the feeling an earthquake gave. She and her father—all the family had gone to the country except those two—were sitting on the third-story piazza enjoying the beautiful moonlight night—it had rained heavily during the day—and then came those awful sounds and the tumbling of the wall and the falling in of the front of the house upon her bed. She was waiting and enjoying the beautiful moonlight night before retiring. They rushed in the dark down stairs. They found all the doors jammed from the contortions of the house. Finally the father burst out through one of them, and they rushed out into the cowyard, that being the furthest point from the house. There they remained for thirty-six hours, and she assured me that it was over twenty-four hours before she knew that she didn't have her slippers on. Now, you can form an idea what the terror was.

MR. DUTTON: Let me ask one more question. During this last earthquake some thought that there was a safe side of the house; but in the second quake that came it would appear that that was a sort of a left-handed shake quake and some of them got left. Now the question I want to ask is this: There is an impression among the people that the cause of the earthquake this last year has been on account of the natural gas escape up in the Pennsylvania region, and it is quite prevalent with the people there that give the subject much thought. The gas goes off in great quantities, and it is a question whether that escape of gas has not something to do with the movement of this thin crust—the undulation of a thin crust of the earth even so far down as Charleston or some of the Southern States This subject has taken possession of the minds of the people to such an extent that they have absolutely moved away. At the time of the earthquake every conceivable reason was given for it, and I think that the bulk of the people think this escape of gas, which is used in Pittsburg to run the machines and goes away in vast quantities, must have something to do with the bowels of the earth. Do you think that it has something to do with it?

DR. MOSES: I have thought of it and thought it might bring about an earthquake, because there is no doubt a diminution of pressure on the inner surface of the crust. Supposing the melted interior and the hardened crust to be two, there is between those probably a layer of steam and gas, but gas under such enormous pressure that it is liquefied. Now it is not improbable that that may have something to do with it; but do you know every day we are experiencing such enormous differences of pressure on the surface of the earth that that of itself may be a partial cause, and a very small additional grain will break the camel's back, and that grain may be this. There has been quarried around the city of Charleston within the last twenty years about two and a half to three millions of tons of phosphate rock.

MR. DUTTON: More than that—estimated at four millions, is it not?

DR. MOSES: I had a paper prepared for the government, and I was thinking of the figures in that. Well, just remove that pressure of three or four millions of tons from any point that is under tension and it is enough to start a crack. Cracks, as I understand it, seem to run along the Charleston and Savannah road and the South Carolina road. Now both of those roads are ballasted with earth taken from the side of the track, and there was already a preliminary crack, and there was where the cracks came—just like a little scratch on a plate glass will cause it to crack.

The discussion ended at this point, and President Davis spoke of the desirability of arranging for a library for the Club in its new Club House. This met with hearty favor from the members present, and it was decided to ask for contributions of books and pamphlets from all members.

Among those who braved the storm of rain and wind to attend were H. C Davis, M. W. Goodyear, Amos Broadnax, Lieut F. W. Toppan, and Paymaster W. C. McGowan, U. S. N., Lieut. Andrews U. S. A., J. H. Blasdell, James W. Godfrey, C. O. Baker, Jr., Dr. Otto A. Moses, Chas. Dutton, Col. Henry Harney. S. Roosevelt Schuyler, Geo. Worthington. Geo. Manson, Geo. L. Beetle, Geo B. Coggesball, H. A. Stout, H. A Reed, James Beesley, W. D. Ludlow, W. H. Landon, Henry H. Sherman; Stephen Holbrooke and H. A. Cleverly, of Philadelphia; Z Latshaw, of Pittsburgh; F. E. Pettingill, of Cleveland.

The next monthly meeting of the club will be held July 21st at the same place.

ELECTRIC LIGHT NEWS

—— Davis, Rhoads & Co. have secured a portion of Western New York as dealers for the Electrical Accumulator Company.

—— At Fort Worth, Texas, the Edison Electric Light and Power Company, capital stock $50,000, has been chartered by J. J. Watkins, Samuel J. Hunter, T. T. Cronise and Max Elser.

—— Prof. A. K. Eaton has moved his factory to 191 Fulton street, Brooklyn, where he will continue the manufacture of electrical instruments and all kinds of instruments of precision.

—— Mr. C. M. Wilder, of this city, a very promising young electrician, is the representative of the Julien Storage Battery Company, of New York, and is not interested in any primary battery in Boston or elsewhere.

—— The Flushing (L. I.) Electric Illuminating Company has been formed, and will install a good sized electric light plant of the Knowles system, owned by the Mutual Electric Manufacturing Company, of Brooklyn.

—— The Underground Electric Light and Power Company, Philadelphia, has notified its patrons along Chestnut street that about the 15th inst. the company will discontinue the arc lighting, and thereafter furnish only incandescent lights.

—— L. C. Kinsey & Co., of Williamsport, Pa., have placed orders for accumulators for use in connection with central station lighting in various places in Eastern Pennsylvania, among which are Reading, Bethlehem, Allentown, Phillipsburg, etc.

—— The American Electric Manufacturing Company are extending their business to Australia. A complete plant with engines, dynamo machines, lamps, boilers, wires, and other apparatus was shipped last week for Sydney. An American plant is to be immediately installed there.

—— The Brush Electric Light and Power Company, of Savannah, Ga., are doing a flourishing business, having 100 city lights and 70 private lights. The company have a five years' contract from the city, and the lights give general satisfaction. There are three 65-light machines in the station.

—— The Brush electric lighting apparatus for Winston, N. C., has arrived and will be installed immediately. Great regret is felt in view of the death of Judge D. H. Starbuck, president of the Winston Brush Company. Judge Starbuck's successor, Mr. D. P. Mast, is, however, a very able man.

—— At the annual meeting of the shareholders of the United States Illuminating Company, held on 21st of June, the following gentlemen were elected directors for the ensuing year: Henry G. Marquand, George Montague, Richard Irwin, jr., James Stokes, Duncan C. Parmly, George W. Hebard, Eugene T. Lynch.

—— The City Council at Galesburg, Ill., have just contracted with the local electric company (Merchants' Electric Illuminating and Power Co.) for eighty-five 2,000 candle-power electric lamps for street lighting. The company run 105 Thomson-Houston lights in stores in a city of 12,000 inhabitants, which shows how well the people appreciate a good light. The company is controlled by the gas company.

—— The National Electric Headlight Company has been formed in Cincinnati, with a capital of $650,000, owning over twenty patents of value relating to electric headlights. We are informed that several of the headlights now owned by this company have been running on railroads for over two years, giving perfect satisfaction. The enterprising railway supply house of Post & Co., Cincinnati, has taken the exclusive manufacture of these lights and intend to push them to the front with every indication of success.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JUNE 21, 1887.

365,040 Electric valve mechanism for water mains; George B. Bassett, Watertown, N. Y.

365,059 Printing telegraph; Samuel V. Essick, Alliance, Ohio.

365,089 Temperature alarm system; Albert E. Morrison, Charlottetown, Prince Edward Island, Canada.

365,103 Automatic telegraphy; Charles Selden, Baltimore, Md., assignor to himself and William T. Barnard, same place, and Francois Van Ryssel-berghe, Brussels, Belgium.

365,116 Apparatus for transforming electric currents; Louis Bollman, Vienna, Austria-Hungary, assignor of one-half to Ernest Biedermann and Demeter Monnier, both of same place.

365,159 and 365,189 Incandescent lamp socket and cut-out; Merle J. Wightman and Hermann Lemp, Hartford, Ct.

365,340 Swivel truck for electric railways; 365,341, Tramway for elevated electric railways, with means for insulating the rails; Benjamin F. Hamilton, Boston, Mass., assignor to the Enos Electric Railway Supply Company, same place.

365,345 Electric railroad signal; Malcom W. Long, Harrisburg, Pa.

365,351 Incandescent electric lamp; Jas. Smith, New Albany, Ind., assignor of one half to J. F. Gebhart, same place.

365,353 Coin-operated electrical weighing scale; William R. Smith, Bandera, Texas, and Albert L. Washburn, New York, said Washburn assignor to said Smith.

365,359 Electric battery; Pierre Germain, Clermont Ferrand, Puy de Dome, France.

BUSINESS NOTICE.

"In making the statements which follow we can verify each and all of them as facts. Mr. Edward P. Thompson, of Temple Court (7 Beekman St.,) New York, is a good man to bring your patent cases to, for he is thoroughly versed in all the ins and outs of a Patent Attorney's duties. The following are some of his qualifications: Graduate of Stevens Institute as Mechanical Engineer. For four years tutor of classes of young men in mathematics and experimental physics at Elizabeth, N. J. Served professionally as Electrician and Chemist in the Swan Electric Company of New York for two years. Because of past successes as a Patent Attorney at 13 Park Row, New York, was appointed, to succeed N. S. Keith, of the patent agency of the *Electrical World* and Associate Editor. N. S. Keith is known as the Translator and Reviser of Schellen's Treatise on "Dynamo Electric Machinery." Mr. Thompson for two years personally prepared and prosecuted all the patent business of *Electrical World's* Patent Agency, and is the author of a series of articles in said paper upon "Analytical and Systematic Method of Inventing," which were widely known and favorably received. Mr. Thompson is a member of American Institute of Electrical Engineers and American Society of Mechanical Engineers. He is author of the "Expansion of Polynomials," which the ablest mathematicians of the world universally commend." —*New York Observer*.

BUSINESS NOTICE.

The business formerly conducted by E. C. Hawks, agent, will hereafter be conducted by the United Carbon Companies (office, Rooms 90 and 91 Wilshire Building, Cleveland, O.), who will endeavor to serve the electric light people to the best of their ability at all times. All communications should be addressed as above.

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"THE WORLD'S FAIR."

A CENTENNIAL EXHIBITION PROPOSED FOR THE YEAR 1892.

A World's Fair is proposed for New York in 1892, the 400th anniversary of the discovery of America by Christopher Columbus. In that year, it is said, Spain will send a fleet to America over the route which Columbus pursued, but, instead of discovering San Salvador, the fleet will arrive in New York about May 1, 1892.

William Euclid Young, a member of the New York Stock Exchange, who is the projector of the new exhibition, says: The United States needs the markets of the world for her products and manufacturers, and in no other way can American manufactures show to the world so effectively and so economically what they make that is needed by other countries as by an occasional national exhibition. The Centennial Exhibition at Philadelphia, in 1876, was visited by 10,500,000 persons, and a World's Fair in New York in 1892 would attract 20,000,000 persons at the least.

Merchants, manufacturers and others desiring space for exhibits are already registering their names, that they may have first choice when the different buildings are completed.

Although the books are now open for registration of applicants for space, we do not propose to demand any deposit for rentals until the 2d day of January, 1892.

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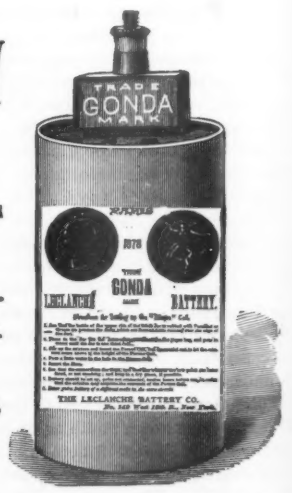

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